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NATURAL ENVIRONMENTAL EFFECTS IN MILITARY MODELS AND SIMULATIONS: PART II—A SURVEY OF CAPABILITIES

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13. ABSTRACT *(Maximum 200 words)*
The Defense Modeling and Simulation Office (DMSO) has sponsored the Environmental Effects for Distributed Interactive Simulation (E^{2}DIS) Project, which is composed of eight tasks including the Survey Task. The Survey Task had three objectives: to develop a baseline of the Military Services' current requirements for incorporation of the atmosphere and near-space environment and their effects in military models and simulations (the Requirements Survey), to identify atmospheric and near-space environmental models and databases and effects models and databases that are currently available from the services (the Capabilities Survey), and to compare the results from both survey efforts and make appropriate recommendations.

In a series of three reports, Part I describes the results and findings from the Requirements Survey; this report, Part II, describes the results and findings from the Capabilities Survey; and Part III compares and assesses the results of both surveys.

The Survey Team received questionnaires for 152 models and databases that were quality controlled and entered into an automated database management system for analysis. The results of the analysis are presented in this report. Both the Capabilities Survey database and the Requirements Survey database are available from PL/GPAA.

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LIST OF ACRONYMS

DIS	Distributed Interactive Simulation
DMSO	Defense Modeling and Simulation Office
DoD	Department of Defense
E^2DIS	Environmental Effects for Distributed Interactive Simulation
M&S	Modeling and Simulation
MEL	Master Environmental Library
QBE	Query By Example
VV&A	Verification, Validation, and Accreditation
VV&C	Verification, Validation, and Certification

NOTE: Acronyms for the models and databases in the Capabilities Survey database and described in the appendices are identified on pp. 16–21 of the text.

EXECUTIVE SUMMARY

During the past few years, there has been growing interest in the Department of Defense (DoD) regarding modeling and simulation (M&S) activities. Leaders in DoD share a special interest in ensuring that military models and simulations are both realistic and relevant. One technical area that has received considerable emphasis is the **natural environment**—the terrain, atmosphere, ocean, and space environment. The Defense Modeling and Simulation Office (DMSO), in particular, has been a leader in this area by sponsoring and funding several projects that seek to improve the use of the natural environmental effects in a variety of Military Services M&S applications.

The DMSO has sponsored the Environmental Effects for Distributed Interactive Simulation (E^2DIS) Project. This effort is a multiagency project that includes scientists primarily from the research laboratories of the Military Services. The E^2DIS Project is composed of eight tasks, one of which is the Survey Task. The survey was conducted by a team designed to ensure tri-service coordination. The lead service laboratory for the Survey Team is the Air Force Phillips Laboratory, assisted by the Army Research Laboratory and the Naval Research Laboratory.

The E^2DIS Project Survey Task was established in part to develop a baseline of the Military Services current requirements for the incorporation of data on the atmosphere and near space environment and their effects in military models and simulations. This was the Survey Team's first task assignment, routinely called the "Requirements Survey." In addition, the Team was charged with identifying atmospheric and near-space-environment models and databases and environmental effects models and databases that are currently available from the Military Services. This second effort is known as the "Capabilities Survey." In a third effort, the Survey Team was assigned to compare the results from both survey efforts and make appropriate recommendations. Another purpose of the Survey Task has been in a support role: to provide the E^2DIS Project-level management personnel with information gleaned during the two survey efforts for their use in guiding the project to meet the needs of the sponsor, the DMSO, and the Military Services M&S community.

This report, the second in a three-part series, documents the results and findings from the Capabilities Survey. A complementary report documents the results from the Requirements Survey. A third report contains a comparison and assessment of the results of both surveys.

The Survey Team developed and implemented a strategy to conduct both the Requirements Survey and the Capabilities Survey. The approach to the strategy included the identification of task drivers for the surveys, development of an execution plan, and implementation of that plan. The major technical task drivers for the Capabilities Survey were (1) scope of the survey task, (2) scope of the Military Services M&S efforts, (3) critical environmental factors for military models and simulations, and (4) value to the warfighter.

Of the 156 environmental models and databases that were identified during the course of the Capabilities Survey, the Survey Team received questionnaires for 152 models and databases. The Team quality-controlled these questionnaires in two ways: by considering each questionnaire's relevance to the Capabilities Survey and by considering the quality of answers to specific questions and informational items in each questionnaire. When necessary, the quality control effort included personal, telephonic, and electronic interviews with the technical expert responsible for the model or database. The net result was that information from all 152 questionnaires was entered into the Capabilities Survey database.

The Capabilities Survey data contained in the database were analyzed by the Survey Team, and the results are presented in this report in aggregate for the 152 environmental models and databases. The quantitative analysis provides technical details on the current capabilities for atmospheric and near space environment in environmental models and databases; it also provides some insights into the support for the M&S community that these capabilities either provide or could provide.

All major atmospheric data and atmospheric effects are available. The two specific atmospheric capabilities most frequently available are transmissivity and clouds, which are available from 24 models and databases. Other frequently available data are temperature, wind, and radiative features, each of which are available from 12 or more models and databases. All of these data are available across a wide range of fidelity in time and space. More than 50 percent of the models and databases provide atmospheric effects on sensors, and 25 percent of the models and databases provide atmospheric effects on military platforms. On the other hand, not even 10 percent of the surveyed models and databases have near-space-environment data capabilities.

The vast majority (97 percent) of the surveyed models and databases support three (of six) DMSO functional areas: Research and Development, Analysis, and Military Operations. This show of support

implies that the remaining functional areas (Test and Evaluation, Production and Logistics, and Education and Training) lack explicit support from the environmental models and databases surveyed.

From a perspective of the M&S hierarchy, the Survey Team noted that Campaign-level models and simulations lack support from the surveyed environmental models and databases. A concentration of support, however, is apparent at the one-on-one M&S hierarchical level, where more than 50 percent of the environmental models and databases surveyed have support capabilities.

FOREWORD

Science and Technology Corporation (STC) is pleased to submit this report "Natural Environmental Effects in Military Models and Simulations: Part II—A Survey of Capabilities," written by Mr. John Burgeson of the STC Nashua, New Hampshire office, and Mr. Thomas M. Piwowar and Dr. Paul D. Try of the STC Washington, DC office. This survey and its companion survey of environmental requirements were developed and conducted under the guidance of the service representatives of the Environmental Effects for Distributed Interactive Simulation (E^2DIS) Survey Team: Mr. Donald Grantham (lead), Phillips Laboratory, Hanscom Air Force Base, Massachusetts; Mr. Sam Brand, Naval Research Laboratory, Monterey, California; and Dr. Alan Wetmore, Army Research Laboratory, White Sands Missile Range, New Mexico. The E^2DIS Survey Team wishes to extend its thanks to the following personnel who assisted in the Capabilities Survey effort: Dr. Harry Heckathorn, Program Manager, E^2DIS ; Lt. Col. J. Lanicci, USAF, Headquarters, Air Staff (AF/XOM); Lt. Col. J. Borger, USAF, Directorate of Weather; Capt. B. Shapiro, USAF, Combat Climatology Center; Dr. G. Ginet, USAF Phillips Laboratory, Geophysics Directorate; Mr. L. Page, Department of the Army; CDR T. Tielking, USN; and Mr. E. Khedouri and Ms. E. Schroder, Naval Research Laboratory.

1. INTRODUCTION

During the past few years, the Department of Defense (DoD) has become increasingly concerned about modeling and simulation (M&S) activities. Leaders in DoD share a special interest in ensuring that military models and simulations are both realistic and relevant. One technical area that has received considerable emphasis is the **natural environment**—the terrain, atmosphere, ocean, and space environment. The Defense Modeling and Simulation Office (DMSO), in particular, has been a leader in this area by sponsoring and funding several projects that seek to improve the use of the natural environmental effects in the Military Services M&S applications. To do so, it was necessary to determine the baseline of M&S environmental requirements and the capabilities to satisfy these requirements.

1.1 BACKGROUND

One such project initiated in fiscal year 1993 is the Environmental Effects for Distributed Interactive Simulation (E^2DIS) Project (Heckathorn, 1994; Naval Research Laboratory, 1994, 1995). This project is a multiagency project under the management lead of the Naval Research Laboratory, Washington, DC, and includes scientists from the research laboratories of the Military Services. The E^2DIS Project is composed of eight tasks, one of which is the Survey Task. The lead service laboratory for the E^2DIS Project Survey Task is the Air Force Phillips Laboratory, Geophysics Directorate, Hanscom Air Force Base, Massachusetts. Army and Navy scientists from the Army Research Laboratory, Battlefield Environment Directorate, White Sands Missile Range, New Mexico, and the Naval Research Laboratory, Marine Meteorology Division, Monterey, California, are assisting Phillips Laboratory in managing the Survey Task.

1.2 PURPOSE

The E^2DIS Project Survey Task established a tri-service team to conduct a survey to baseline the current status of the incorporation of data on the atmosphere and near space environment and the effects of these natural environments in military models and simulations. The Survey Team was also charged with identifying potential future requirements for incorporation of data on the atmosphere and near space environment, and their effects, in these models and simulations. Another purpose of the surveys was to provide information to E^2DIS Project-level management personnel for their use in guiding the project to meet the needs of the sponsor, the DMSO, and the Military Services M&S community.

A priori, the E^2DIS Project assumed that there might be some shortfalls or deficiencies in incorporating the natural environment. Therefore, the Survey Team was assigned the additional responsibilities of (1) identifying and cataloging the DoD environmental models and databases that might be useful in more realistically representing the atmosphere and near space environment, and (2) assessing the capabilities of these environmental models versus the requirements for the incorporation of data on the atmosphere and near space environment in military models and simulations. This report catalogs the atmospheric and near-space-environment models and databases only.

1.3 SURVEY FOCUS

One of the first key steps for any project or task is to determine the scope, or constraints, of the effort desired. The E^2DIS Project Survey Team concluded early on that the focus of its efforts should be directed toward the Military Services in terms of their M&S environmental requirements and their environmental modeling and database capabilities. For the technical constraint on its effort, the Survey Team was specifically assigned to focus on the atmosphere and near space environment only. The focus was concentrated on environmental modeling and database capabilities available on electronic data processing systems, although some capabilities described only in the literature were also surveyed. Some examples of other catalogs of environmental capabilities are the *Directory of Climatic Databases*, AFCCC/TN-96/001, January 1996; *Selective Guide to Climatic Data Sources*, U.S. Department of Commerce, National Environmental Data and Information Service, December 1988; and *Guide to Standard Weather Summaries and Climatic Services*, Naval Air Systems Command, Washington, DC, NAVAIR-50-1C-534, April 1986.

The Survey Team noted that modeling and simulation database requirements for the terrain portion of the natural environment were already surveyed and documented under the aegis of an earlier DMSO-sponsored project led by the Defense Mapping Agency (1993). Ocean requirements for military models and simulations and ocean modeling and database capabilities are being identified by another DMSO-sponsored project, the Master Environmental Library (MEL) Project (Siquig et al., 1995). The Survey Team members have coordinated with the personnel developing the DMSO projects to avoid duplication of survey efforts.

2. SURVEY STRATEGY

The E^{2}DIS Project Survey Team determined that prior to executing its task some planning was critical to achieving success with its survey efforts. During the planning phase, a basic approach was identified, discussed, and agreed upon. This approach included three fundamental components: (1) identification of key task "drivers," (2) development of an execution plan for the surveys, and (3) implementation of the plan and other associated task efforts.

2.1 TASK DRIVERS

For any task, certain key factors, or drivers, dominate how the task is performed. Early recognition and identification of these factors assist greatly in formulating a reasonable strategy to accomplish the task. For this survey effort, the Survey Team responded to the following task drivers:

- Approach to surveying environmental capabilities
- Critical environmental factors for Military Services models and simulations
- Value to the warfighter
- Time and funding constraints

These are discussed in the following subsections.

2.1.1 Approach to Surveying Environmental Capabilities

The first key driver for the Survey Task was the perceived scope of the Military Services M&S user community and the Military Services environmental database and modeling community. Similar to the approach taken for the Requirements Survey (Piwowar et al., 1996), the Survey Team chose a "top-down" approach, as opposed to a "bottom-up" approach, for the development and execution of its tasking effort for the Capabilities Survey. The top-down approach essentially meant that the Survey Team would initially coordinate any survey plan with each of the four Military Services headquarters principal points of contact for atmospheric and near-space-environment models and databases. The bottom-up approach, on the other hand, would have meant that the Survey Team would pursue numerous, individual points of contact within the Military Services environmental modeling and database community.

The Survey Team selected the top-down approach because such an approach would make the Military Services headquarters aware of the survey and inform the principal points of contact of the intent

of the survey well before the subordinate organizations were requested to expend personnel resources in response to any survey questions. The Survey Team considered this an important advantage in case difficulties were experienced in getting responses to survey questions. Although the top-down approach would equate to more time being spent initially coordinating the Capabilities Survey effort with the Military Services headquarters, the Survey Team's government representatives accepted the minimal scheduled risk in view of the benefits associated with this approach.

2.1.2 Critical Environmental Factors for Military Services Models and Simulations

The essence of the entire survey effort centered around the identification and defining of the Military Services requirements for incorporation of data on the natural environment—the atmosphere and the near space environment—in the Services M&S activities. In other words, it was necessary to determine the critical environmental factors for each model and simulation. This key task driver dominated the survey effort. It was reflected in the number of items requesting information posed to both the Military Services M&S community and the environmental modeling and database community. (Subsection 2.3 contains an indepth discussion on this material and the questionnaire that was developed to support the Capabilities Survey effort.)

2.1.3 Value to the Warfighter

Another key driver was "Value to the Warfighter." Warfighters are the ultimate customers for all the Military Services M&S activities, either directly or indirectly, individually or collectively. Their operational experiences in the real world's natural environment provide them with first-hand familiarity of the effects the natural environment can have on their own forces, platforms, weapons, communications, and sensor systems—and the enemy's as well. **For a simulation to be realistic, hence, valuable, in the eyes of a warfighter, the effects of the natural environment should be properly taken into account.** The structure of the Survey Questionnaire attempted to use terms familiar to warfighters, as well as terms familiar to the military environmental modeling and database community.

2.1.4 Time and Funding Constraints

Two significant drivers for most tasks are time and funding constraints. The E^2DIS Project Survey Task was no different. It was limited to 2 years, which ended September 1995. Funding constraints limited the amount of personnel resources assigned. These two constraints combined, consequently, to limit the number of M&S efforts pursued.

2.2 EXECUTION PLAN DEVELOPMENT

Given the key task drivers, the Survey Team developed a plan to execute its top-down strategy. This plan included the following major components:

- Soliciting support from the DMSO and key service points of contact
- Developing and testing the Capabilities Questionnaire
- Drafting and coordinating the letters of intent
- Conducting the survey using questionnaires and telephone and personal interviews with technical experts
- Designing and managing a database
- Analyzing the data from returned questionnaires
- Reporting the results of the analysis

These components are discussed in the following subsections.

2.2.1 The DMSO and Military Services Support

Liaison visits, meetings, and briefings were conducted early in the Survey Task's schedule to obtain support in principle from the DMSO and the Military Services. Consistent with the top-down approach, the first such visit was made to the DMSO representative for the E^2DIS Project in August 1993. The DMSO representative provided the Survey Team with an overview of DMSO background, mission, goal, and objectives. This visit indicated that the DMSO was fully supportive of the E^2DIS Project in general and the Survey Task effort in particular.

Visits and meetings with the points of contact of the Army, Navy, Marine Corps, and Air Force staffs were subsequently conducted. All four Services were briefed on the E^2DIS Project and the Project Survey Task effort. They unanimously agreed to the intentions of the survey and affirmed their support for future coordination efforts associated with the Survey Task.

2.2.2 Capabilities Questionnaire

Based on the collective experience of the Survey Team members, a questionnaire for the Capabilities Survey was developed. The following subsections describe not only this development but also the testing of the Capabilities Questionnaire.

2.2.2.1 Development

In parallel with soliciting and garnering support from the DMSO and the four Military Services, development of questionnaires for both the Requirements Survey and the Capabilities Survey began. Since the results of both surveys (i.e., the responses from both the Requirements and Capabilities Questionnaires) would eventually be compared and assessed, the E^2DIS Project Survey Team decided to structure the questionnaires as similarly as possible. Both questionnaires were divided into two parts: administrative information and technical information. A copy of the Capabilities Questionnaire is presented as Appendix A.

The administrative information section of the Capabilities Questionnaire requested information on such items as the model or database title, a brief general description of the model or database, and the identity of a technical expert for the model or database, as well as the principal service owner. This type of information would be critical in attempting to perform quality control, or followup work, on the responses to various questions.

Using the top-down approach, the Survey Team decided to develop some applications items and questions based on the M&S technical structure that was established by the DMSO in conjunction with the Military Services and other DoD component organizations. In this way the Survey Team sought to construct a framework for the questionnaires that would be relevant to and understandable by the DMSO and the Military Services M&S community.

The technical information section of the questionnaire was the essence of the survey. It has seven subsections and three attachments. The seven subsections are discussed below.

1. **Critical Environmental Factors**. The Survey Team considered that it was important for the respondents to highlight early in the questionnaire the critical factors for the model or database regarding the atmosphere and near space environment. At this point technical experts for the model or database were also provided with an opportunity to respond in qualitative terms to the key atmospheric and near-space-environment issues without going into detailed quantitative responses, which are required later in the questionnaire. The Survey Team also anticipated that responses for this subsection could be used to assist in quality controlling the questionnaire's more detailed answers.

2. **Status of the Model or Database**. The respondents were asked for only a few basic facts concerning the status of the model or database. The Survey Team wanted to know: Is the model or database being used today? If so, how often? If it is not being used today, when will it be used?

3. **Application of the Model or Database**. Application is often a key reference point. Information was requested about the application of the model or database in terms of its use in DIS, the type of simulation it is used for, its functional use, its hierarchical category, the types of applications supported, its military contents, and its documentation. In this subsection the DMSO technical structure was explicitly integrated. Specifically, the Survey Team used the three types of simulations (i.e., constructive, virtual, and live play) in one item. The next item contained a list of six functional areas: Education and Training, Research and Development, Test and Evaluation, Analysis, Production and Logistics, and Military Operations (Under Secretary of Defense for Acquisition and Technology, 1995).

During an early liaison visit with an Air Force representative, an important point on the hierarchy of models and simulations was made by the representative. *De facto* in the Air Force, models and simulations were categorized according to the scheme shown in Figure 1.

This scheme, however, raised another corollary issue: If the Air Force had such a hierarchy, do the other services have a modeling and simulation hierarchy? After several visits and conversations with representatives from the Army, Navy, and Marine Corps, it was determined that only the Army had an established M&S hierarchy. It is shown in Figure 2.

As shown in Figures 1 and 2, the Air Force hierarchy is platform and weapon system oriented while the Army hierarchy is force and personnel oriented. An item for the Capabilities Questionnaire was developed that incorporated both hierarchies.

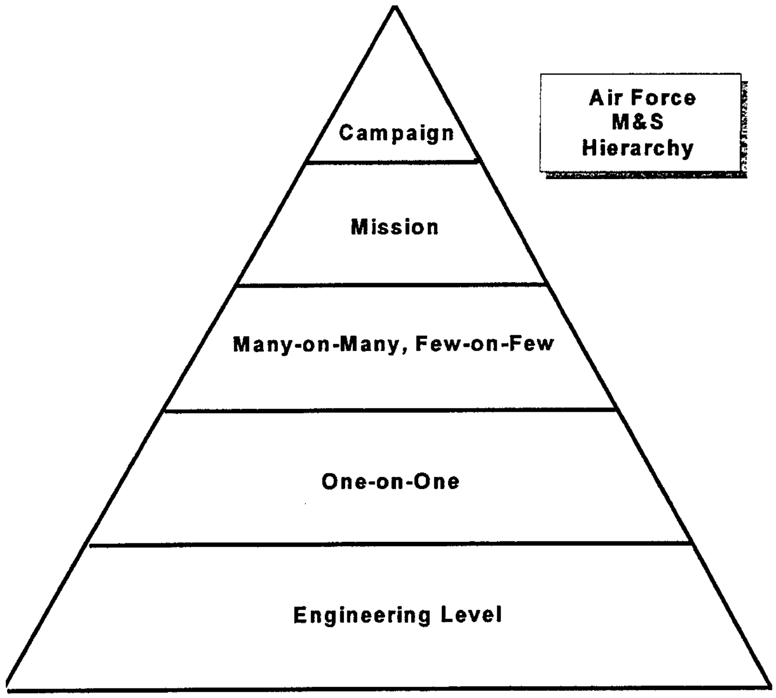

Figure 1. Air Force hierarchy of models and simulations.

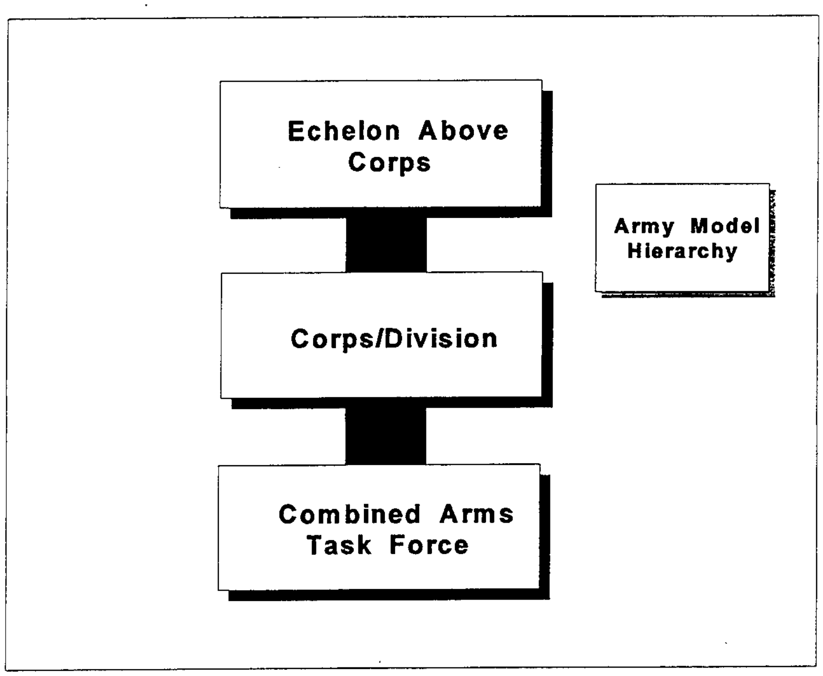

Figure 2. Army hierarchy of models and simulations.

In the Applications subsection respondents were queried on the specific military aspects of the model or database. Information was requested on the types of applications supported, such as sensor acquisition of targets and mobility of forces and platforms. In addition, order-of-battle information was requested in general terms to help in understanding the complexity and use of the model or simulation.

The next-to-last item in the Applications subsection requested identification of a user manual for the model or database. The last item requested information on the primary customer for the model or database.

4. **Domain of the Model or Database**. The Survey Team categorized the model or simulation's domain in terms of the space (horizontal surface and vertical) dimensions and time dimension. Again, this information was needed to help the Survey Team understand the complexity and use of the model or database. The items pertaining to the horizontal and vertical domains included references to the ocean environment. This information was included to assist the MEL Project team members in their complementary survey effort of ocean capabilities for military models and simulations.

5. **Current Capabilities**. Given the preceding subsections of the questionnaire, which were relatively general in nature, this subsection focused on detailed quantitative questions and informational items about the model or database's current capabilities for atmospheric data and effects and near-space-environment data and effects. Three attachments requested detailed information. The first attachment focused on the atmosphere. The second attachment contained similar choices for the near space environment. The third attachment sought information on other technical areas, such as verification, validation, and accreditation. Answers to these detailed capabilities-oriented questions and items were necessary for the Survey Team to compare with answers resulting from the Requirements Survey questionnaires and to assess this comparison.

6. **Future Capabilities**. A few questions and informational items were posed in this subsection of the Capabilities Questionnaire to determine if the model or simulation was planned for an upgrade. If so, whether the upgrade might change the current capabilities

for atmospheric or near-space-environment data; if not, whether an upgrade should be considered if environmental data and environmental effects data would be required by a simulation user.

7. **E^{2}DIS Project Briefing**. The Survey Team considered the possibility that some Capabilities Questionnaire respondents might not be familiar with the E^{2}DIS Project. It was decided that a question be included in the Capabilities Questionnaire that requested respondents to indicate the need for a briefing on the project.

2.2.2.2 Beta test

Before distributing the Capabilities Questionnaire to the many different organizations in the Military Services, the Survey Team conducted a beta test on the questionnaire. Representatives from the Air Force Environmental Technical Applications Center (USAFETAC, which was renamed the Air Force Combat Climatology Center [AFCCC] on 1 August 1995) and Air Force Phillips Laboratory (USAF/PL) volunteered to perform this test. Some substantive comments and recommendations were received and integrated into the questionnaire to improve its quality. Appendix A contains the final version of the Capabilities Questionnaire used in the survey.

2.2.3 Letters of Intent

To implement the survey, the Survey Team drafted a letter that described the overall intent of the Capabilities Survey and provided a copy of the Capabilities Questionnaire for information. Taking the top-down approach, the Survey Team coordinated draft letters with the Military Services environmental modeling and database community.

The Survey Team coordinated meetings and briefings to discuss the intent of the draft letter with each of the Military Services primary point of contact for M&S. The Air Force was the first service to release a letter to its organizations. The Army and Navy followed within a few weeks to release their letters. It should be noted that the Navy was also responsible for requesting responses from the Marine Corps and the Coast Guard. Copies of the Air Force, Army, and Navy correspondence are contained in Appendix B.

2.2.4 Interviews

The Survey Team perceived the interview process with technical experts for the environmental models and databases as optional in the event any capabilities questionnaires were returned with incomplete or unclear responses.

2.2.5 Database

The Survey Team selected off-the-shelf software, *PARADOX for Windows*–Version 5, for database management of the Requirements Survey and Capabilities Survey sets of data. The program provided an efficient, structured method to organize, archive, retrieve, analyze, and display data.

2.2.5.1 Database design

Using the capabilities of the *PARADOX for Windows* software program, the Survey Team designed the Capabilities Survey database to accomplish two important goals:

- Provide a standard methodology by which the large amount of surveyed information could be managed.
- Ensure that the database could be easily understood by anyone familiar with relational databases and be *relatively* easy to use by someone who was not completely familiar with relational databases.

With these two goals in mind, the Survey Team designed the database such that the Capabilities Questionnaire was associated with 23 database tables. All 23 database tables corresponded directly to questions in the Capabilities Questionnaire.

Each database table contained relational information and a common field that allowed the tables to be linked together. Typically, this linkage was accomplished by using a "model or simulation tracking number," which was an arbitrary, but unique, number assigned to each questionnaire received. Each record (row), or group of records, in a table corresponded to a specific questionnaire; each field (column) corresponded to a specific questionnaire entry. The model or simulation tracking number was used in most of the database tables as the initial field entry.

In keeping with sound relational database development theory and practice, the database tables were small in terms of the number of fields. No table had more than 18 fields, and most tables had 10 or less. The

database tables, their relationship to the Capabilities Questionnaire, and the contents of each field in a table are described in detail in Appendix C.

2.2.5.2 Database management

The Capabilities Survey accumulated a formidable amount of data from the 152 questionnaires. The Survey Team personnel archived the data by manually entering the data from each of the capabilities questionnaires received into the appropriate database tables. To minimize opening and closing tables and to allow checking of similar data for inconsistencies or input errors, data for the same portion of several questionnaires were entered into the appropriate database table simultaneously. After sufficient data were entered into these tables, retrieval and analysis of the data could begin.

The database management system has the capability, called Query By Example (QBE), to ask questions (or queries) about data, explore data in the database, and obtain answers quickly. A query can be a simple question in a single table, or a complex question involving several tables. The QBE provided a powerful means to extract pertinent information from a large amount of data that otherwise would have been difficult to analyze. The results of queries, called "answer tables," were used as basic input for the Survey Team's analysis reported in Section 3. In addition, database management system "reports" that summarize and display relational information were generated and used by the Survey Team to analyze the acquired data.

One example of a database management system report that the Survey Team used was "LISTCAPB.RSL." It is a report that sorts the models and databases first by service, then alphabetically by model or simulation title. Also included in the report is a description of the model or database, as well as the critical environmental factors or issues that pertain. A listing of all database management system reports used by the Survey Team is given in Appendix D.

2.2.5.3 Database availability

The complete database consists of tables, queries, and reports in *PARADOX for Windows–* Version 5.0. It can be obtained from the Phillips Laboratory/Geophysics Directorate Atmospheric Structures Branch (PL/GPAA), 23 Randolph Road, Hanscom Air Force Base, Massachusetts, 01731-3010.

2.2.6 Analysis of Data

Reliance on the QBE capabilities of the *PARADOX for Windows* software program was fundamental in planning for the quantitative analysis of the Capabilities Survey technical data. By simply querying the Capabilities Survey database, retrieval and analysis of responses to each question and item from the technical section of the Capabilities Questionnaire was planned.

For each item having prescribed multiple choices for answers, sorted sets of answers were retrieved. All questionnaires responding with the same answer choice to a given item were grouped, or sorted, into a set; the number of sorted sets, therefore, corresponded to the number of possible answer choices for that given item. The use of soft-copy answer tables and paper-copy tabular reports was planned for the initial analysis of the basic, sorted answer sets. Graphical display and additional analysis of these same basic answer sets were also planned for the report-writing phase. Using *Word Perfect Draw 3.0* as the software graphics program, answer sets for each question would be displayed in soft copy and analyzed.

Not all the items had multiple choice answers, however. Each item that required a free-formatted, fill-in-the-blank type answer had to be reviewed and compared with the same item and corresponding answer in other questionnaires. Again the QBE capability would be used to query the database for these types of answers. Where similar answers were being provided, the Survey Team would plan to sort those into arbitrary groups for use in further analysis and final reporting.

To determine whether there might be a relationship between responses to one item and responses to another item, second-generation answer tables and reports could, and would, be constructed. Again the QBE capability would be used when necessary.

2.2.7 Report of Results

The final major component, or step, in developing the Survey Execution Plan was to report the results of the analysis of the Capabilities Survey data. This report was developed to record such results, including responses to all the items and questions from the technical section of the Capabilities Questionnaire. It is organized in a typical technical or scientific report format and is the second report in the series: Natural Environmental Effects in Military Models and Simulations: Part I—A Survey of Requirements; Natural Environmental Effects in Military Models and Simulations: Part II—A Survey of Capabilities; and Natural Environmental Effects in Military Models and Simulations: Part III—An Analysis

of Requirements Versus Capabilities. The results of the Capabilities Survey in conjunction with the results of the complementary E^2DIS Project Requirements Survey will contribute to the understanding of some technical aspects of both the Military Services M&S and environmental science communities.

2.3 IMPLEMENTATION

With the signing, release, and distribution of the first service letter (the Air Force letter of 22 December 1994, officially announcing the intent of the survey effort within the Air Force), the Capabilities Survey implementation phase began. Simultaneous with this implementation, the Survey Team continued to coordinate with the Army and Navy until they announced the E^2DIS Project Capabilities Survey via formal letters. (See Appendix B for correspondence from the Air Force, Army, and Navy regarding these announcements.) Included in the Navy's distribution was a Coast Guard organization that eventually provided a completed questionnaire on an iceberg model. Since this questionnaire does not contain any atmospheric or near-space-environment data capabilities, it is not applicable to the E^2DIS Project Capabilities Survey; however, it should be useful for the MEL Project Survey Task. A summary of the Military Services responses is shown in Table 1. Appendix E provides a list of all the models and databases surveyed and Appendix F provides a description of each model and database.

Table 1. Capabilities Survey Results

Service/ Agency	Capabilities Survey Results			
	No. of Organizations Polled	No. of Organizations Responding	No. of Major M&S Efforts	No. of Questionnaires Completed
Army	6	5	31	31
Navy	26	14	60	58
Marine Corps	1	0	0	0
Air Force	7	3	65	63
Coast Guard	1	1	0	0
Totals	41	23	156	152

The Survey Team made a concerted effort to ensure that the quality of the returned capabilities questionnaires was adequate in terms of applicability and detail. This two-pronged quality control effort meant that each questionnaire was reviewed for general applicability to the Capabilities Survey and, if passing that test, was reviewed in detail for completeness. As a result of the first step in the quality control effort, one capabilities questionnaire from the Coast Guard (identified in the preceding paragraph) was not entered. The applicable 152 capabilities questionnaires were scrutinized for completeness and, when necessary, the Survey Team contacted the technical expert indicated on the questionnaire about missing or unclear answers.

It is important to note that the Survey Team placed particular quality control emphasis on ensuring that answers to questions and items related to atmospheric and near-space-environment data types and associated time and space resolutions were provided. These answers, crucial to the overall effort of the Team, are the basis for comparing the modeling capabilities of the environmental science community with the requirements of the M&S community for the same atmospheric and near-space-environment data types. This comparison is reported in Burgeson et al., 1996.

The list of environmental models and databases that were used by the Survey Team to compile the results in this document is duplicated here. In Appendix F the list is expanded to include a brief description of each model and database, along with the identified technical point of contact and critical environmental factors.

Service or Agency	Models and Databases in the Capabilities Survey Database	Model/DB No.[1]
Army:	1. AGAUS–A Mie Code	639
	2. BITS–Broadband Integrated Transmittances	612
	3. CLIMAT–The Climatology Model	613
	4. COMBIC–Combined Obscuration Model for Battlefield-Induced Contaminants	614
	5. COPTER–Obscuration Due to Helicopter-Lofted Snow and Dust Module	615
	6. FASCAT–Atmospheric Illumination Module	616
	7. FITTE–The Fire-Induced Transmission and Turbulence Effects Module	617
	8. GRNADE–Self-Screening Applications Module	618
	9. ILUMA–Natural Illumination Under Realistic Weather Conditions	619
	10. KWIK–A Munition Expenditures Module	620
	11. LASS–Large Area Screening Systems Application Module	621
	12. LOWTRN–Atmospheric Transmittance/Radiance Module	622
	13. LZTRAN–Laser Transmittance Module	623
	14. MPLUME–Missile Smoke Plume Obscuration Code	624
	15. NAPS–Noise Assessment and Prediction System	637
	16. NBSCAT–Narrow Beam Multiple Scattering Module	625
	17. NMMW–Near-Millimeter Wave Module	626
	18. NOVAE–Nonlinear Aerosol Vaporization and Breakdown Effects Module	627
	19. OVRCST–Contrast Transmission Module	628
	20. PEGASUS	601
	21. PFNDAT–Aerosol Phase Function Database	629
	22. RADAR–Millimeter Wave System Performance Module	630
	23. REFRAC–Optical Path Bending Code Module	631
	24. SCAPE–Scanning Parabolic Equation	636
	25. SCAPPIF–Scanning Fast Field Program Module	632
	26. Spherical–Ground Impedance Model Based on Equations by Attenborough	638
	27. SWOE–Smart Weapons Operability Enhancement	610

[1]The model or database identification number describes the order of the sorting in Appendix F.

Service or Agency	Models and Databases in the Capabilities Survey Database	Model/DB No.
Army: (continued)	28. Synthetic Environments	609
	29. TARGAC–Target Acquisition Model	633
	30. UVTRAN–An Ultraviolet Transmission and Lidar Simulation Module	634
	31. XSCALE–Natural Extinction Module	635
Navy:	1. AIRICE–Aircraft Icing	707
	2. AAW–Anti-Air Warfare Aircraft Stationing Aid	708
	3. BALWIN–Meteorological Ballistic Winds and Densities Model	709
	4. BGV–Battle Group Vulnerability	710
	5. CARDS–Create Atmosphere Refractive Data Set	711
	6. CCD–Chaff Corridor Density Model	712
	7. CHADIS–Chaff Dispersion and Density Model	715
	8. CHATRA–Chaff Trajectory Function Model	713
	9. CLUTTER–The Ocean-Atmosphere Model Library (OAML) Navy Standard Radar Sea Clutter Model	714
	10. COAMPS–Coupled Ocean/Atmosphere Mesoscale Prediction System	733
	11. D-Values	719
	12. DMED–Direct Method Evaporation Duct Model	734
	13. ECM–Electronic Countermeasures Effectiveness Display	738
	14. EDH–Evaporation Duct Height Model	739
	15. EM COVER–Electromagnetic Coverage Diagram	740
	16. EM LOSS–Electromagnetic Path-Loss vs. Range	741
	17. ESM–Electronic Support Measures Range Tables	742
	18. FLIR–Forward-Looking Infrared System Prediction	743
	19. HEPC–Historical Electromagnetic Propagation Conditions	744
	20. HF COMMS–High Frequency Communications	745
	21. HF LUF–High Frequency Lowest Usable Frequency	747
	22. HF MUF–High Frequency Maximum Usable Frequency	749
	23. HWS–Historical Wind Speed	746
	24. LRP–Laser Range Prediction	748

Service or Agency	Models and Databases in the Capabilities Survey Database	Model/DB No.
Navy: (continued)	25. MVOI–Multivariate Optimum Interpolation	750
	26. NOGAPS–Navy Operational Global Atmospheric Prediction System	706
	27. NORAPS–Navy Operational Regional Atmospheric Prediction System	705
	28. ODP–Orbit Determination Program	702
	29. Ooyama Analysis	751
	30. PADA–Pressure Altitude/Density Altitude	752
	31. PCS–Electromagnetic Propagation Conditions Summary	737
	32. PIBAL–Pilot Balloon	753
	33. Platform Vulnerability	754
	34. RADFO–Radiological Fallout	755
	35. RFSDR–Radar Free-Space Detection Range	756
	36. RIA–Radiosonde Initial Analysis	757
	37. RPO–Radio Physics Optics	758
	38. RRM–Rowland-Rotter Evaporation Duct Model	735
	39. Seasonal Cloud Amount and Cloud-Free Line-of-Sight Data for Oceans	761
	40. SEP–Seakeeping Evaluation Program Wind and Wave Database	701
	41. SHIP ICE–Ship Ice Accretion	759
	42. SLAP–Solar/Lunar Almanac Program	724
	43. SOCUS–Sound Focus	725
	44. Standard EM Prop–Standard Electromagnetic Propagation	727
	45. STE–Submarine Technological Environmental Database, Clouds	704
	46. SRR–Surface Search Radar Range Table	728
	47. SSTAC–Sea Surface Temperature Analysis and Composite	726
	48. TASM–Tomahawk Anti-Ship Missile Effective Wind Model	729
	49. TECA–Tomahawk Environmental Calculation Aid	730
	50. TEKBS–Tactical Environmental Knowledge Base System	703
	51. TEMPER–Tropospheric Electromagnetic Parabolic Equation Routine	736
	52. TEMP UTIL–Temperature Utility	731
	53. TESR–Tactical/Environmental Ship Routing	732

Service or Agency	Models and Databases in the Capabilities Survey Database	Model/DB No.
Navy: (continued)	54. TLAM Wind and Temperature Correction–Tomahawk Land Attack Missile Wind and Temperature Correction Model	723
	55. Tropical Cyclone Module	722
	56. TRUE WIND–Wind Conversion Utility	721
	57. VLSTRACK–Chemical/Biological Agent Vapor, Liquid, and Solid Model	760
	58. Warnings Plot	720
Air Force:	1. 3DNEPH–Three Dimensional Nephanalysis (stored in 6-month increments)	544
	2. 3DNEPH-LMHT/A Hemispheric	545
	3. 5-Layer Cloud Model	523
	4. A Climatological Model for 1-Minute Precipitation Rates	558
	5. ACT/EOS–Air Combat Targeting/Electro-Optical Simulation	503
	6. AFGL-TR-89-0012, Effects of Rain Attenuation on Satellite EHF Communication in the United States	557
	7. AGRMET	521
	8. ARC/AARC–Atmospheric Radiance/Auroral Atmospheric Radiance Code	512
	9. ASPAM–Atmospheric Slant Range Path Analysis Model	522
	10. Boundary Layer Window Analysis	548
	11. CBSD–Celestial Background Scene Descriptor	556
	12. Clear and Cloud-Free Lines-of-Sight from Aircraft	563
	13. CSSM–Cloud Scene Simulation Model	511
	14. CRRESPRO–Combined Radiation and Release Effects Satellite Proton Flux Model	514
	15. CRRESRAD–Combined Radiation and Release Effects Satellite Space Radiation Model	515
	16. DATSAV2 Aircraft	536
	17. DATSAV2 Rocketsonde	534
	18. DATSAV2 Satellite	533
	19. DATSAV2 Surface	531

Service or Agency	Models and Databases in the Capabilities Survey Database	Model/DB No.
Air Force: (continued)	20. DATSAV2 Upper Air	535
	21. Drop-Size Distribution Associated with Intense Rainfall	559
	22. Eighth Mesh Surface Temperature Analysis	547
	23. EOTDA–Electro-Optical Tactical Decision Aid	501
	24. Estimating Probabilities of Cloud-Free Fields-of-View from Earth Through the Atmosphere	562
	25. FASCOD3	505
	26. High Resolution Analysis	546
	27. High Resolution Cloud Prognosis	524
	28. HIRAS/GSM–High Resolution Analysis System/Global Spectral Model	525
	29. IAPM–Improved Aurora Precipitation Model	516
	30. Interplanetary Shock Model	517
	31. JAD–Jacchia Atmospheric Density Model	554
	32. Lightning	540
	33. Magnetospheric Specification and Forecast	518
	34. Military Standard 210C, Climatic Information to Determine Design and Test Requirements for Military Systems and Equipment (MIL-STD-201C)	560
	35. MODTRAN3	506
	36. MOSART–Moderate Spectral Atmospheric Radiance and Transmittance	507
	37. NOWS–Night Vision Goggle Operations	502
	38. NOWS Weather Software Database	504
	39. PIBAL	537
	40. PLEXUS	513
	41. Probability-of-Cloud Statistics (P Cloud S)	566
	42. RTNEPH–Real-Time Nephanalysis	526
	43. RTNEPH 6-Month (stored in 6-month increments)	541
	44. RTNEPH Histogram	542
	45. RTNEPH-LMHT/A Hemispheric	543
	46. Radiosonde	539

Service or Agency	Models and Databases in the Capabilities Survey Database	Model/DB No.
Air Force: (continued)	47. RWM–Relocatable Window Model	527
	48. SAMM–SHARC and MODTRAN Merged	509
	49. SESFS–Space Environmental Specification and Forecast System	555
	50. SHARC–Strategic High Altitude Radiance Code	508
	51. SNODEP–Snow Depth	528
	52. Snow Depth Climatology	551
	53. Solar Flare Forecast Model	520
	54. Solar Wind Transport Model	519
	55. Summary of the Day	532
	56. Surface Temperature Model–SFCTMP	529
	57. Synthetic 3-D Atmospheric Temperature	510
	58. TRONEW Cloud Model–New Tropical Cloud Model	530
	59. Universal Methods for Estimating Probabilities of Cloud-Free Lines-of-Sight Through the Atmosphere	561
	60. Upper-Air Window Analysis	549
	61. Vertical Velocity Analysis	550
	62. Winds Aloft	538

3. ANALYSIS

This section describes the approach taken to analyze the data acquired during the Capabilities Survey, and describes why the approach was taken. The layout of the data presentation and the results derived from analyzing the data are discussed. The analysis covers all significant responses to the Capabilities Questionnaire and provides the principal quantitative basis for the recommendations proposed in Section 4.

3.1 APPROACH

The technical analysis of any data set has to consider the preferences, biases, and viewpoints of the customer who is expected to use the results of the analysis. In the case of this survey effort, the Survey Team, based on the collective experience of its members, perceived two **communities of customers** that might be interested in the results of the Requirements Survey and the Capabilities Survey:

- The M&S community in each of the Military Services
- The environmental modeling and database community in each of the Military Services

As mentioned in the introduction of this document, the Survey Team's perception prior to conducting this survey effort was that the two communities of customers had infrequent interaction with each other. The current survey effort has generally corroborated that perception. The Requirements Survey interviews, in particular, indicated that each customer community lacked knowledge, in some cases fundamental knowledge, of the technical requirements and capabilities of the other customer community. Consequently, the Survey Team attempted to overcome this lack of knowledge by identifying a set of technical issues that both customer groups might use to establish a common baseline for further discussion, interaction, and, perhaps, joint partnership. Such interaction might, in turn, lead to improvement in the realism of the Military Services M&S efforts, as well as providing the Services priorities for research and development of atmospheric and near-space-environment databases and models. To communicate these technical issues, the Survey Team attempted to construct both the Requirements Questionnaire and the Capabilities Questionnaire, the database, and the analysis framework in a manner that was understandable to both communities of customers.

Within each of these two communities of customers, the Survey Team perceived two **levels of management** that might have an interest in the survey results:

- The staff headquarters level where broad, aggregated information is used to make programmatic decisions
- The individual project manager level where much more specific information is required for decisions

Using the top-down approach, the Survey Team organized both questionnaires and associated databases such that analyses were made from the perspective of a Military Service headquarters representative, as well as from the viewpoint of an individual project manager within that service. Typically, the Service headquarters M&S representative and the environmental modeling and database representative were interested in "big picture" programmatic issues. For example, a question from the Service headquarters M&S representative might have been "Which of my service's models require environmental data input?" or, "What are the critical environmental factors or data types for my service's models?" On the other hand, the Service headquarters environmental modeling and database representative might have asked "On what environmental data types should I focus my research to support the M&S community?" At the individual project manager level, technical questions or issues were more narrowly focused. An M&S community project manager might have asked "What is available to satisfy my simulator's requirement for cloud data?", while the environmental modeling and database community project manager might have asked "Who in the M&S community needs the cloud data that I am archiving?"

The analysis made by the Survey Team, therefore, is an initial step in identifying technical issues. It seeks to begin the process of communicating such technical issues to two diverse service communities for their consideration. Results, findings, and recommendations from the Requirements Survey have been provided in the Survey Team's requirements document (Piwowar et al., 1996) to assist in this communication process. With an analysis of the atmospheric and near-space-environment database and modeling capabilities highlighted in this catalog, the Survey Team continues the process of communicating technical issues for consideration by the DMSO and the Military Services.

3.2 DATA PRESENTATION

For this capabilities document, the display of data in Subsection 3.3 is generally organized according to the sequence of questions contained in the Capabilities Questionnaire (Appendix A). Displayed in the

document are analyses of responses for each question in the Capabilities Questionnaire for the entire set of 152 questionnaires in the database. The Survey Team has taken this approach to summarize the overall response to the Capabilities Survey. Graphical and tabular presentations are provided to aid the reader in understanding the responses and, therefore, the capabilities of the Military Services environmental database and modeling community.

3.3 RESULTS

Substantial amounts of data have been received from the 152 capabilities questionnaires. The answers provided by these questionnaires have been verified with the technical points of contact to ensure the credibility of the database and, hence, the basis for the Survey Team's capabilities analysis. All 152 questionnaires have been quality controlled for applicability to the Capabilities Survey and completeness in terms of answers to the questions and informational items in the technical section of the questionnaire.

3.3.1 Functional Use and Hierarchy

The analysis begins with a table containing the number of responses to questions and informational items in the Capabilities Questionnaire that inquire about the functional use and hierarchical categories associated with the model or database. Some returned questionnaires indicated more than one choice for either the DMSO functional area or hierarchical level categories, or both. Only the responses from each questionnaire that indicated the "predominant category" for both the DMSO functional area and hierarchical level categories have been counted. The count is shown in Table 2.

The data in Table 2 indicate that there are three dominant functional areas for the databases and models surveyed. Of the 152 databases and models surveyed, 148, or 97 percent, are associated with Research and Development, Analysis, and Military Operations. **One result gleaned from this table is the lack of databases and models identified as supporting the other three DMSO functional areas (i.e., Test and Evaluation, Production and Logistics, and Education and Training). Another unexpected result is the lack of supporting environmental databases and models for the Campaign-level models and simulations.**

Table 2. Databases and Models Categorized by DMSO Functional Area and Hierarchical Level

Model/ Simulation Hierarchical Level	DMSO Functional Areas						Totals
	Research and Develop-ment	Test and Evaluation	Analysis	Production and Logistics	Military Operations	Education and Training	
Campaign					1		1
Mission	2		12		5		19
Many-on-Many / Few-on-Few		1	10		1		12
1-on-1	33		21		25		79
Engineering	13	1	4		3		21
Not Indicated	6		4		8	2	20
Totals	54	2	51	0	43	2	152

3.3.2 Components of Military Simulations

In Section 5.3 of the requirements document (Piwowar et al., 1996) the six major components of military simulations were discussed. From that information, the 152 environmental models and databases making up the survey were grouped into three of those major components: environmental databases, environmental models, and environmental effects models. The distribution of the environmental models and databases in the three groups is shown in Figure 3. Appendix G provides a listing of the databases and models that are grouped into each of the three major components of the military simulations.

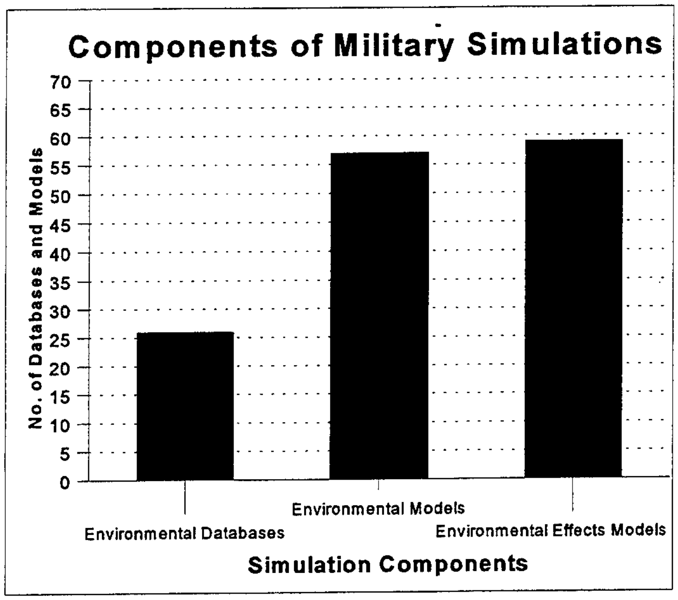

Figure 3. Surveyed environmental databases and models grouped as components of military simulations.

3.3.3 Types of Applications Supported

In the Capabilities Questionnaire the respondents were asked to identify the types of applications supported by the model or database. The four choices for answers were sensor acquisition of targets, mobility of platforms and forces, decision aids for command and control authority, and other. Respondents were permitted to choose more than one answer. Figure 4 depicts nearly an even split between decision aids for command and control authority and sensor acquisition of targets; together they account for 92 percent of the responses.

3.3.4 Military Object Families Supported

The next item requested the respondents to identify missions, forces, platforms, weapon systems, communications systems, sensors, and targets to which their environmental capabilities are applied. These seven categories of military components can also be termed "military object families." Figure 5 depicts the number of models and databases applied to each military object family. The platforms peak stands out, followed by applications to sensors, missions, and weapons.

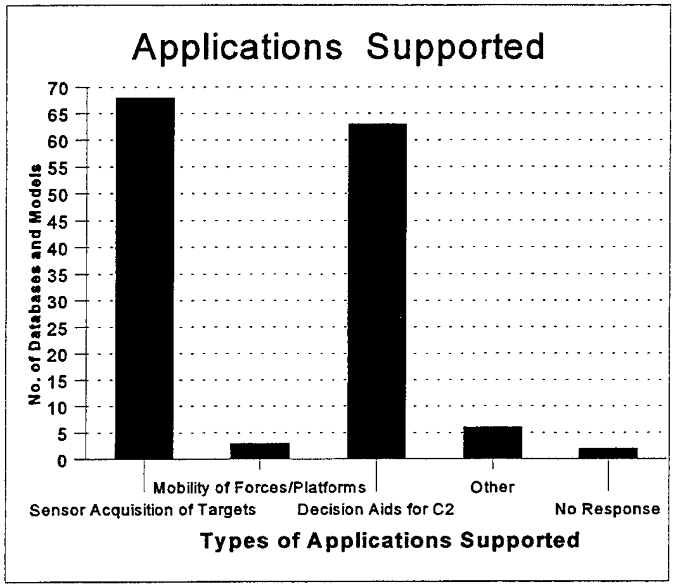

Figure 4. Applications supported by the environmental databases and models surveyed.

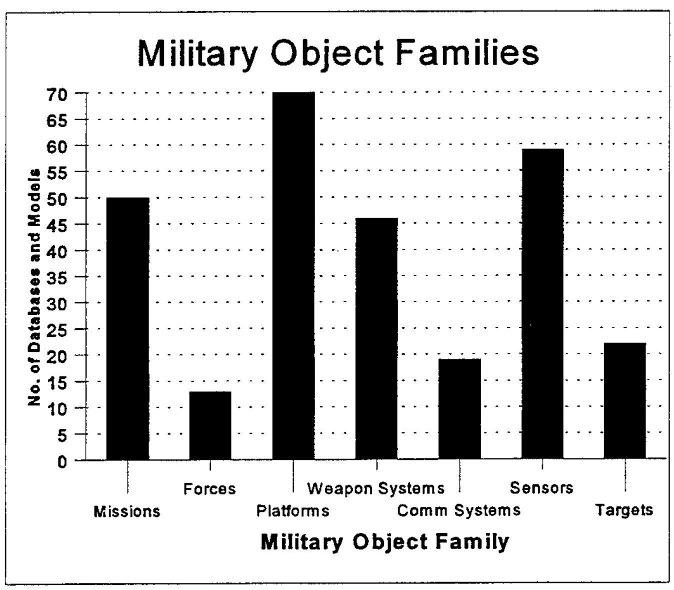

Figure 5. Military object families included in the environmental databases and models surveyed.

3.3.5 Domains

The next item in the Capabilities Questionnaire inquired about the model or database domains: horizontal surface, vertical, and time. The results are described in the following subsections.

3.3.5.1 Horizontal surface domain

Nine possible answers were provided in the questionnaire for the respondent. The respondent was requested to select as many as were applicable but to indicate the model or database's predominant horizontal domain as well. Figure 6 depicts the predominant domain and other applicable domains for the various models and databases. Note that global and global land domains account for 78 percent (55 percent and 23 percent, respectively) of the responses in this survey set. Only 9 of the 152 models and databases have secondary domains.

3.3.5.2 Vertical domain

For the applicable and predominant vertical domains of the models and databases, seven possible answers were provided as choices. Figure 7 depicts the response to those choices. The atmosphere dominates the survey dataset with 79 percent of the predominant domain and 51 percent of the secondary domain.

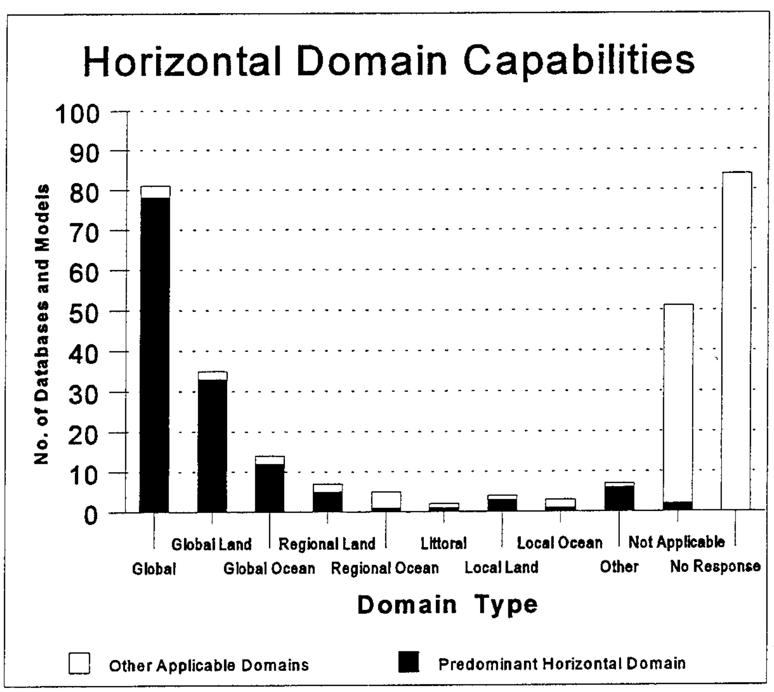

Figure 6. Horizontal domain capabilities associated with the environmental models and databases surveyed.

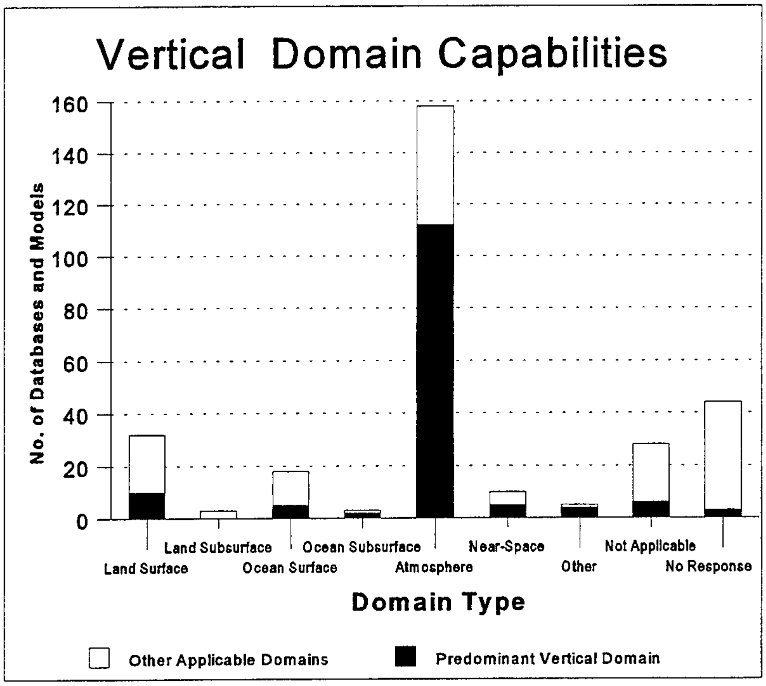

Figure 7. Vertical domain capabilities associated with the environmental models and databases surveyed.

3.3.5.3 Time domain

Respondents were also asked to provide information on the time domain for their model or database, both in terms of the typical time period being represented and the maximum time period that can be represented. Figure 8 presents the results of the responses. The peak at hours accounts for 47 percent of the surveyed environmental capabilities with typical time scales, and the two surrounding secondary peaks at minutes and days account for 40 percent. Note that time is not applicable to 33 percent of the surveyed models and databases.

3.3.6 Current Capabilities

Responses in this section refer to capabilities that are satisfied today. Respondents were queried about the grid used in the model or database, the types of environmental data and effects provided, and other technical information.

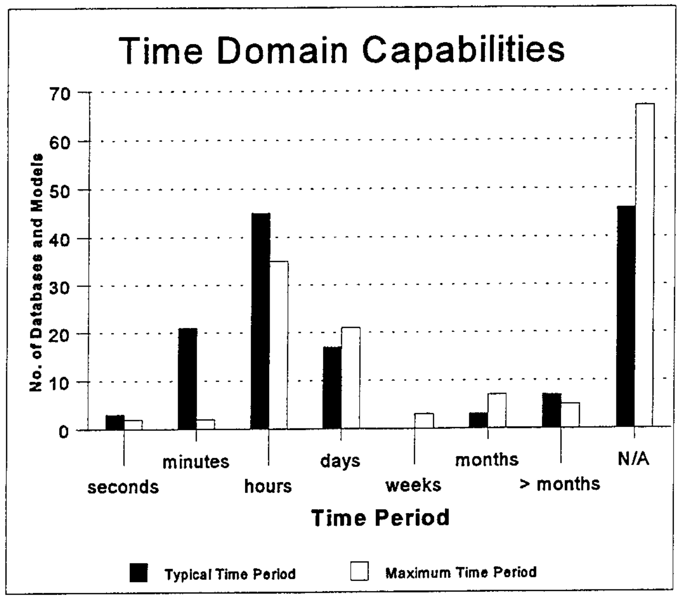

Figure 8. Time domain capabilities associated with the environmental models and databases surveyed.

3.3.6.1 Grids

A question was asked about the typical grid used by the model or database. Figure 9 depicts the results of the responses. Approximately 30 percent of the models and databases used Cartesian or latitude-longitude types of grids.

A question was also asked about the typical map projection used. Figure 10 indicates that nearly half of the models and databases surveyed did not use a map projection. Mercator projections were used by 44 percent of the environmental capabilities that are represented on a map projection.

3.3.6.2 Environmental data

The questionnaire listed 26 atmospheric data types and 23 near-space-environment data types for the respondents to describe the output of their model or the contents of their database, that is, the environmental capabilities of either the model or database. Respondents were requested to indicate whether their model or database **currently outputs** these data types or has the **potential** to provide them. For those data types currently being used, respondents were also asked to indicate the fidelity of each data type. In addition to the capability of providing atmospheric and near-space-environment data, respondents were also asked

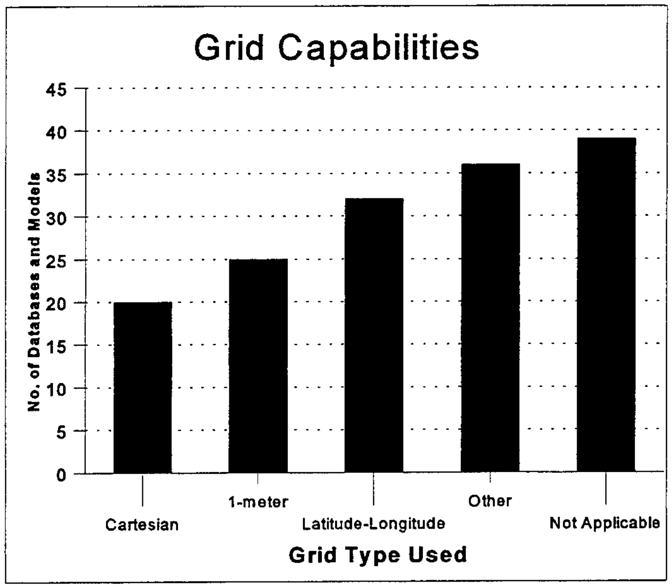

Figure 9. Grid types used in the environmental databases and models surveyed.

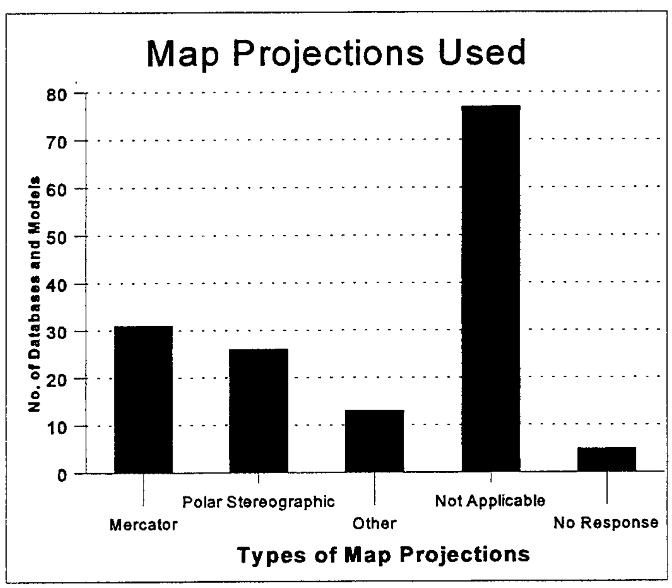

Figure 10. Types of map projections used in the environmental databases and models surveyed.

to identify any other environmental data types or environmental effects (e.g., those associated with terrain or the ocean) available from their model or database. In the following categories, details are provided on the responses for (1) atmospheric data, (2) near-space-environment data, and (3) environmental data.

Atmospheric data capabilities. This subsection describes the atmospheric data fidelity capabilities of the models and databases surveyed. The Capabilities Questionnaire was primarily focused on the **quantitative** aspects of the fidelity capabilities: respondents were queried about the types of atmospheric data provided and the spatial and temporal resolution capabilities for each data type.

Figure 11 depicts the total number of models and databases surveyed that were identified to have current (115) and potential (116) capabilities of providing any of the 26 atmospheric data types listed in the next category. Of the models and databases surveyed 76 percent (115 of 152) provide atmospheric data, and only one additional model has the potential to provide atmospheric data.

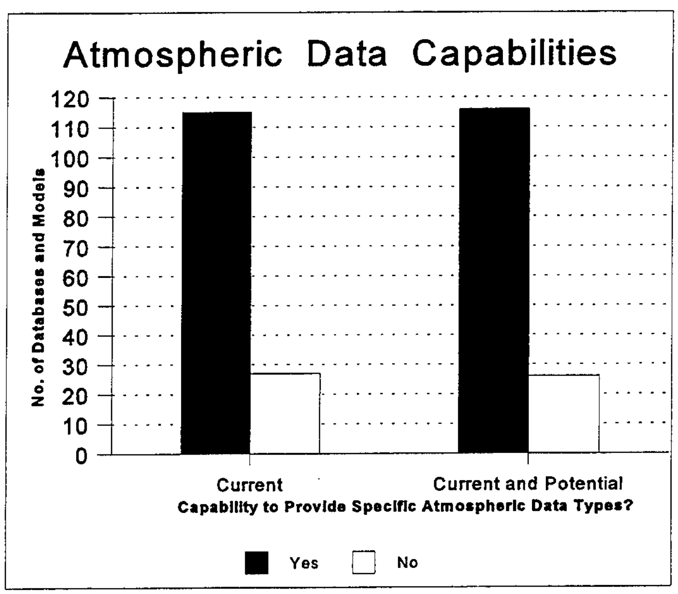

Figure 11. The number of environmental databases and models surveyed that have a current, or current and potential, capability to provide at least one of the specific atmospheric data types listed in the text.

Atmospheric data types. Attachment 1 of the Capabilities Questionnaire (Appendix A) contains an expanded list of the 26 atmospheric data types, as well as items on fidelity and potential capabilities. Each of the data types is cross-referenced in Appendix H to the models and databases described in Appendix F and appears in the following summary list.

1. Aerosols
2. Atmospheric Electricity
3. Clouds
4. Dew Point
5. Fog
6. Humidity
7. Mixing Ratio
8. Precipitation
9. Refractivity
10. Sea Level Pressure
11. Static Stability
12. Temperature
13. Trace Gases
14. Transmissivity
15. Visibility
16. Wind
17. Wind Features (e.g., hurricanes)
18. Radiative Features (e.g., sky brightness)
19. Smoke
20. Chaff Dispersion
21. Combat-generated Dust
22. Contrail Formation and Dispersion
23. Dispersal of Biological and Chemical Agents
24. Nonnuclear Munitions Effects
25. Nuclear Weapons Detonation Effects
26. Ship Exhaust Tracks

Figure 12 depicts the number of capabilities that provide each atmospheric data type. **Note that data types 14 (transmissivity) and 3 (clouds) dominate the list of current capabilities, being provided by 25 and 24 models or databases, respectively.** Temperature, wind, and radiative features account for secondary peaks that are 60 percent or more of the primary peaks. Accounting for the models and databases that also have the potential to provide atmospheric data types by adding them to the current capabilities does not change the dominant peaks, as shown in Figure 12.

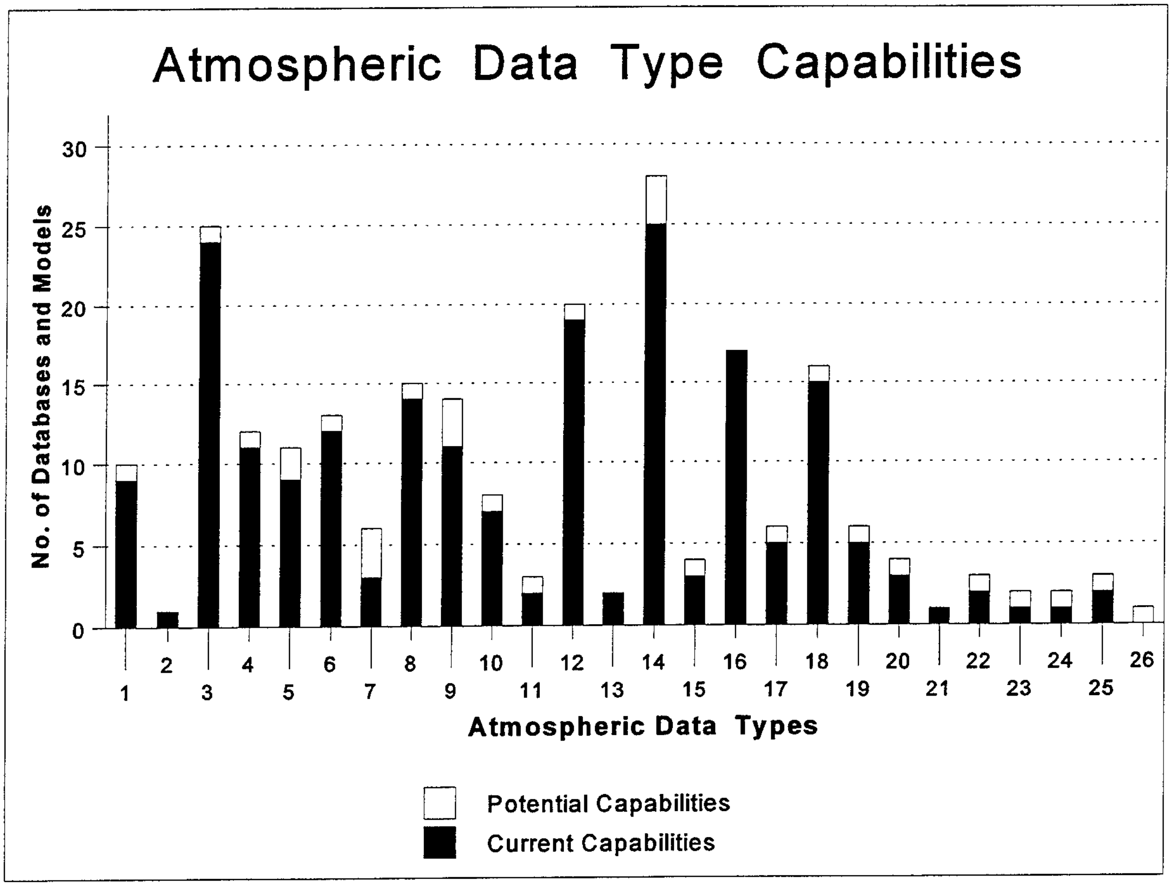

Figure 12. The number of environmental databases and models surveyed having a capability to provide a specific atmospheric data type. The 26 atmospheric data types are listed in the text.

Atmospheric data resolution capabilities. Along with choices about the specific atmospheric data types available from each model or simulation, respondents were also queried about the spatial and temporal resolution of each data type. Figures 13–16 depict the distributions of these resolution capabilities.

Of the 152 surveyed models and databases included in Figure 11, 81 currently provide atmospheric data at a specified fidelity. Respondents have identified at least one resolution capability for each of these models and databases, as shown in Figure 13 (which depicts space and temporal fidelity). Of these 81 models and databases, 58 have a single horizontal resolution capability and 7 have more than one, 48 have a single capability for vertical resolutions and 9 have more than one, and 51 have a single capability for time resolutions and 9 have more than one.

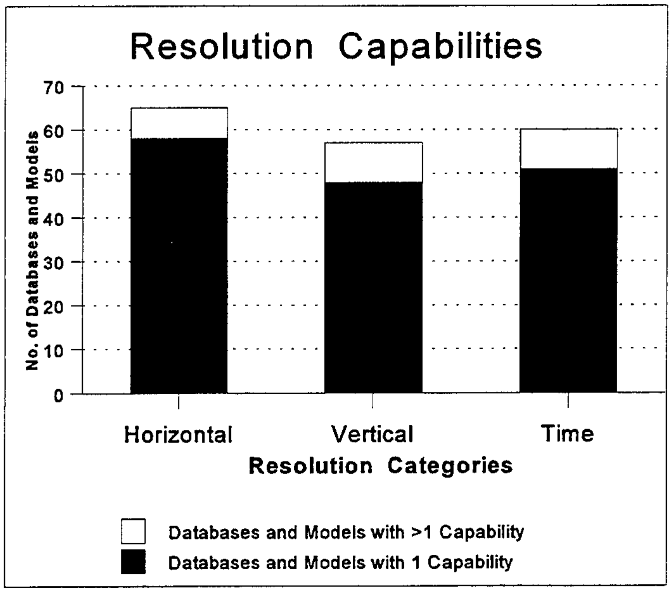

Figure 13. The number of databases and models surveyed having horizontal, vertical, and time resolution capabilities.

As shown in Figure 13, only 7 of the 65 models and databases that provide atmospheric data at specified horizontal resolutions have the capability to provide that data at more than one scale. The available horizontal scales cover a wide range, dominated by peaks at 1 m and 100 km, as shown in Figure 14.

Nine of the 57 databases and models with vertical resolution capabilities (Figure 13) have more than one capability. Of these nine databases and models, eight have two unique vertical capabilities and one has three; the vertical resolution capabilities total 66 and are shown in Figure 15. These capabilities cover a wide range, but those at 1 m dominate.

Nine of the 60 models and databases with a time resolution capability (Figure 13) have more than one capability; each of these nine has two unique capabilities. Time resolution capabilities therefore total 69, as shown in Figure 16. Similar to the available horizontal and vertical resolution scales, there is a wide range of time scales although no one time scale dominates.

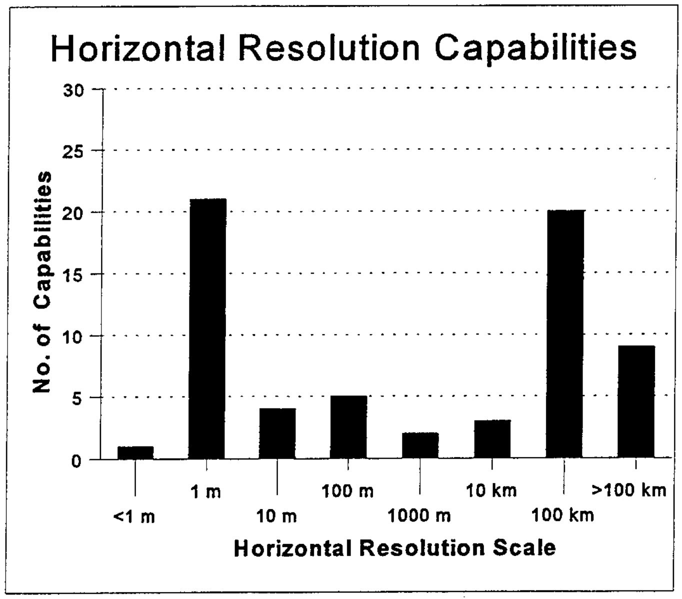

Figure 14. Horizontal resolution capabilities of the environmental databases and models surveyed.

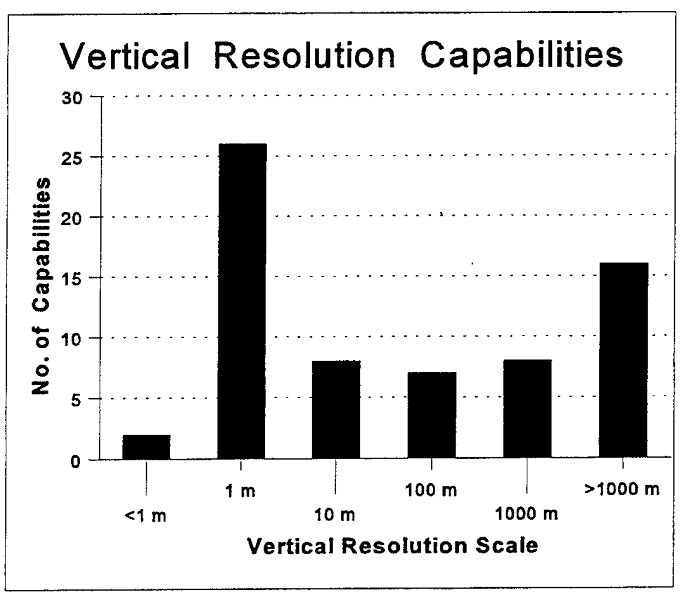

Figure 15. Vertical resolution capabilities of the environmental databases and models surveyed.

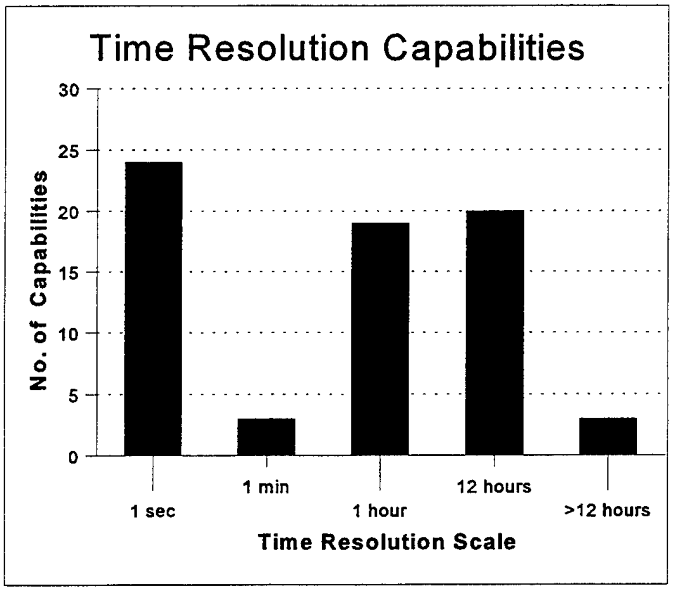

Figure 16. Time resolution capabilities for the environmental databases and models surveyed.

Atmospheric effects capabilities. Respondents were asked for information on the capability of providing specific atmospheric data types and at what resolution. The Capabilities Questionnaire also contained a request for information regarding the availability of atmospheric effects in each model and database. The items were expressed in terms of the atmospheric effects on military objects (i.e., forces, platforms, weapon systems, communications systems, and sensors), which are the same military objects identified in a previous item in the questionnaire and discussed briefly in Subsection 3.3.4. The responses from this earlier item provide a basic understanding of the types of military objects that use the atmospheric effects provided by each model or database.

Figure 17 depicts the results of the responses to the requests for information on atmospheric effects capabilities. For convenience, Figure 17 also includes the results shown in Figure 5. Clearly, capabilities to provide atmospheric effects on sensors dominate the set of models and databases in this survey.

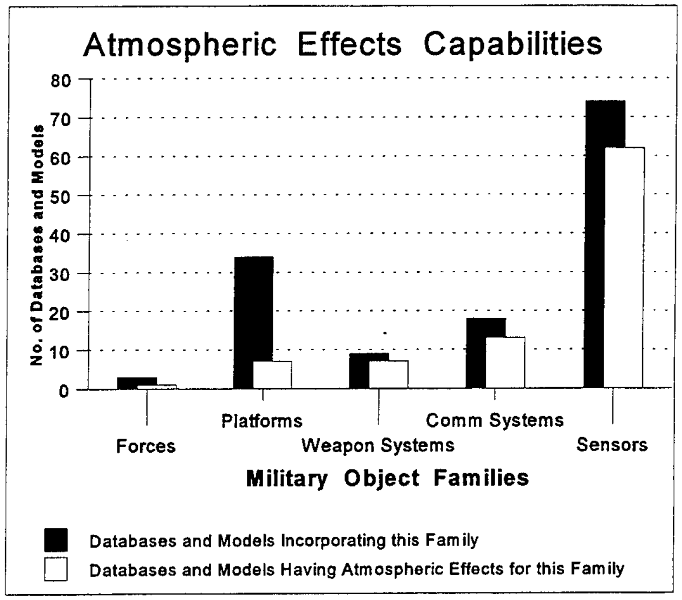

Figure 17. Databases and models surveyed incorporating a military object family and having atmospheric effects for that family.

Near-space data capabilities. The categories that follow describe the near space data fidelity capabilities for the models and databases surveyed. Similar to the atmospheric data portion, the Capabilities Questionnaire was primarily focused on the **quantitative** aspects of the fidelity capabilities available for the near space data. Respondents were queried about the types of near-space-environment data required and the spatial and temporal resolution capabilities for each data type.

Figure 18 depicts the number of models and databases surveyed that were identified to have current and potential capabilities to provide any type of near-space-environment data. Only 13 of the 152 surveyed models and databases have current capabilities; none have the potential capability to provide near space data. Hence, the side-by-side bar graphs in Figure 18 are the same.

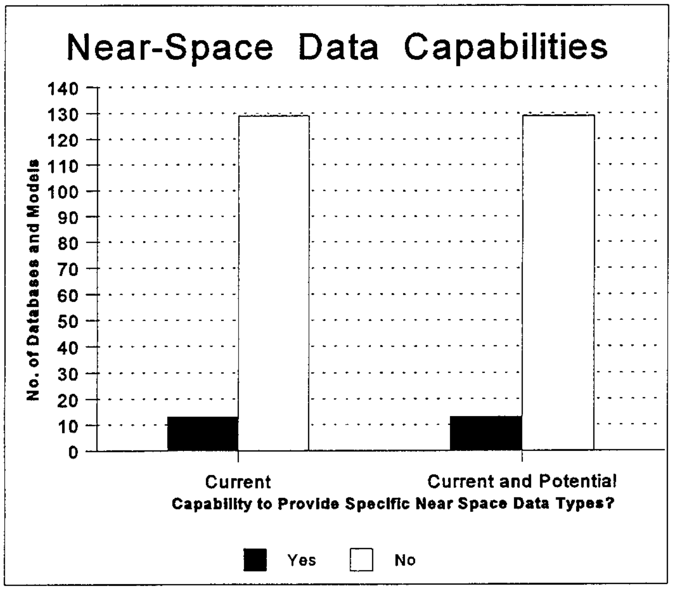

Figure 18. The number of environmental databases and models surveyed that have a current, or current and potential, capability to provide at least one of the specific near space data types listed in the text.

Near space data types. Attachment 2 of the Capabilities Questionnaire (Appendix A) contains an expanded list of the 23 near space data types, as well as informational items on fidelity and potential capabilities. Each of the data types is cross-referenced in Appendix I to the models and databases described in Appendix F and appears in the following summary list.

1. Auroral Particle Precipitation
2. Cosmic Rays
3. Diffuse Zodiacal Emission
4. Geomagnetic Field
5. Interplanetary Medium
6. Low Energy Plasma Environment
7. Lunar Parameters
8. Meteoroids and Debris
9. Neutral Environment
10. Radio Background Noise
11. Solar Parameters
12. Star and Planetary Positions
13. Energetic Particles
14. Geomagnetic Storms
15. Gravity Waves
16. Noctilucent Clouds
17. Polar Cap Absorption
18. Sporadic E
19. Sudden Ionospheric Storms
20. Dispersal of Flares
21. Formation and Dispersal of Rocket Exhaust
22. Munitions Effects (Nonnuclear)
23. Nuclear Weapons Detonation Effects

For the 13 models and databases having the capability to provide the near space data types listed, Figure 19 depicts the number of unique capabilities to provide each near-space-environment data type. **Near space data type 11, solar parameters (i.e., solar position, solar radiative flux, sunspot activity, and solar index), is provided most; followed by data types 14 and 1, geomagnetic storms and auroral particle precipitation, respectively.** Caution must be exercised, however, in interpreting such a small data sample.

Near space data resolution capabilities. Respondents to the Capabilities Questionnaire identified resolution capabilities for 9 of the 13 models and databases that can provide near-space-environment data. **All had horizontal scales, eight had vertical scales, and six had time scales, but only time scales lend themselves to analysis.** Figure 20 depicts the distribution of the time resolution capabilities for near-space-environment data associated with the six models and databases.

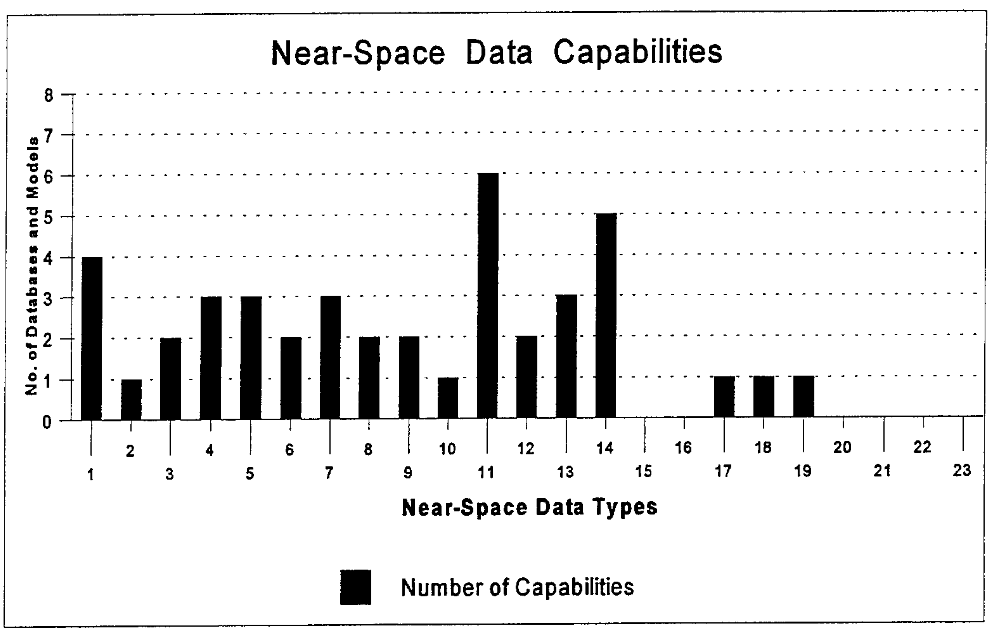

Figure 19. The number of environmental databases and models having capabilities for near space data types listed in the text.

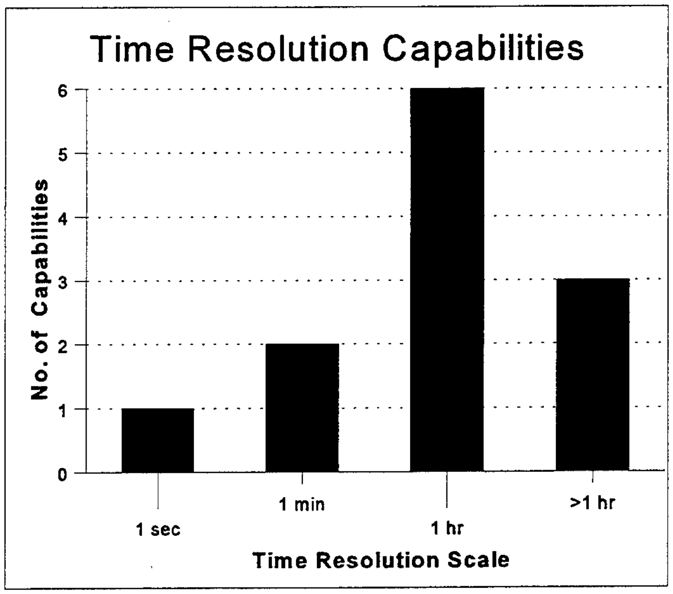

Figure 20. The number of time resolution scale capabilities associated with the databases and models having near space data types.

Near-space-environment effects capabilities. Similar to the section on atmospheric effects, the respondents were asked for information on the capabilities of the databases and models. Again, the items were expressed in terms of the effects of the near space environment on a variety of military objects (i.e., forces, platforms, weapon systems, communications systems, and sensors). These five military object families are discussed briefly in Subsection 3.3.4. Figure 21 depicts the results of the responses. For convenience, Figure 21 includes the results shown in Figure 5. Clearly, **the responses indicate that a small number of databases and models provide near-space-environment effects.**

Other environmental data and effects capabilities. The Capabilities Questionnaire included a request for information about capabilities for any type of environmental data and effects other than those associated with the atmosphere and near space environment. Responses to this query were received from only 11 of the 152 model and database questionnaires. The results are shown in Figure 22.

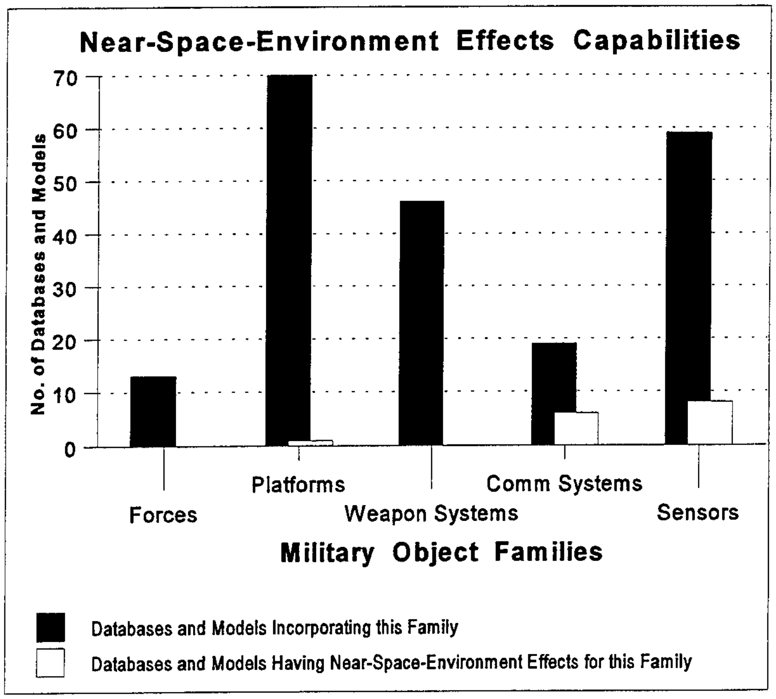

Figure 21. Databases and models surveyed incorporating a military object family and having near-space-environment effects for that family.

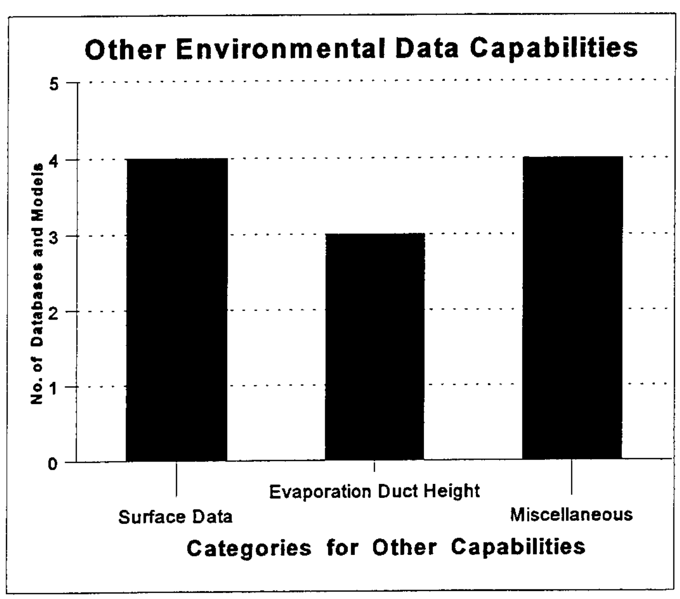

Figure 22. The number of databases and models having capabilities for environmental data types other than those atmospheric and near-space-environment data types listed in the text.

3.3.6.3 Other technical capabilities

Besides inquiries about the primary technical focus of the survey effort (i.e., capabilities to provide atmospheric and near-space-environment data and effects data), the Capabilities Questionnaire included questions and informational items about other capabilities of each model or database. Results associated with these other capabilities—such as scalability; compatibility; accessibility; verification, validation, and accreditation; and currency—are described below.

(1) **Scalability capabilities.** A question was posed about a capability for scalability, that is, the capability of the database or model to increase or decrease its spatial or time resolution. As indicated in Figure 23, 120 responses to this question were received. Only 12 of these 152 models and databases have scalability capabilities.

(2) **Compatibility capabilities.** A series of questions was asked about the software and hardware associated with each model and simulation.

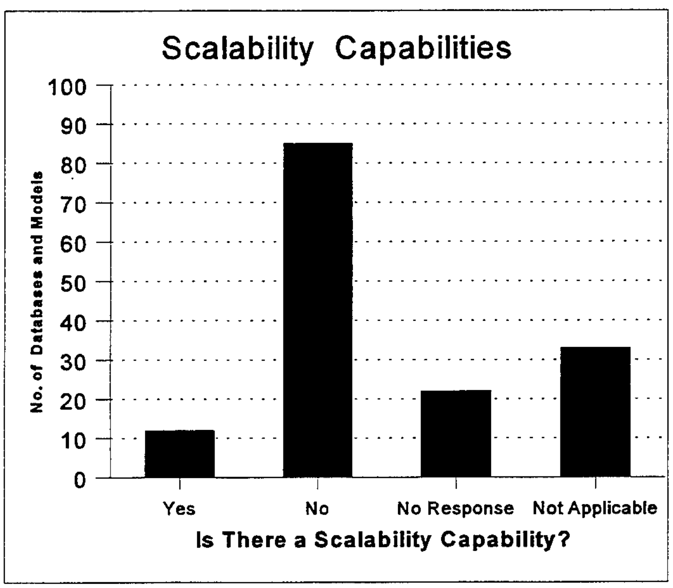

Figure 23. The number of databases and models surveyed having a scalability capability, i.e., the capability to increase or decrease time or spatial resolution.

Questions were posed about the operating system, programming languages, database management system, and any near-term changes to these three components. Figures 24–27 depict the response results.

The GFMPL/TESS (Geophysical Fleet Mission Programming Library/Tactical Environmental Support System) slightly dominates the operating systems presented in Figure 24, although this naval system is used by less than one-quarter of the surveyed models and databases. FORTRAN is clearly the preferred programming language, as shown in Figure 25. For the database management systems, however, there is no clear preference, as shown in Figure 26. Of the models and databases surveyed 19 percent will have near-term (i.e., by FY-97) changes, as shown in Figure 27.

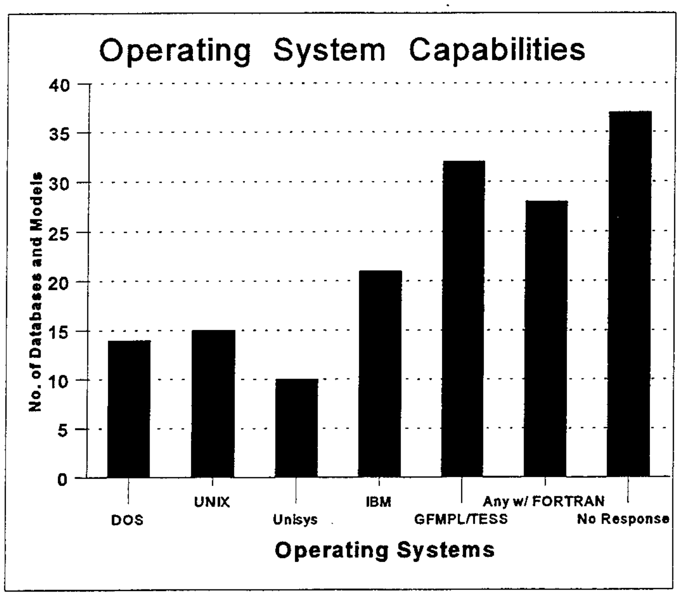

Figure 24. Operating system capabilities for the databases and models surveyed.

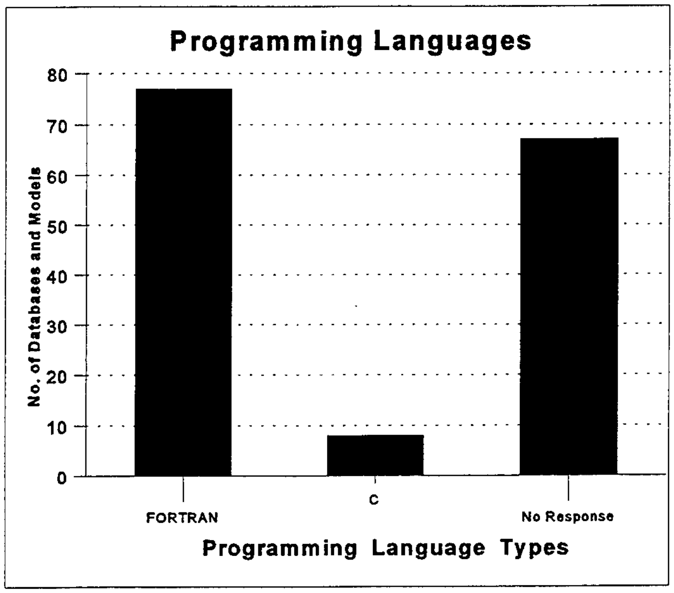

Figure 25. Preferred programming languages for the databases and models surveyed.

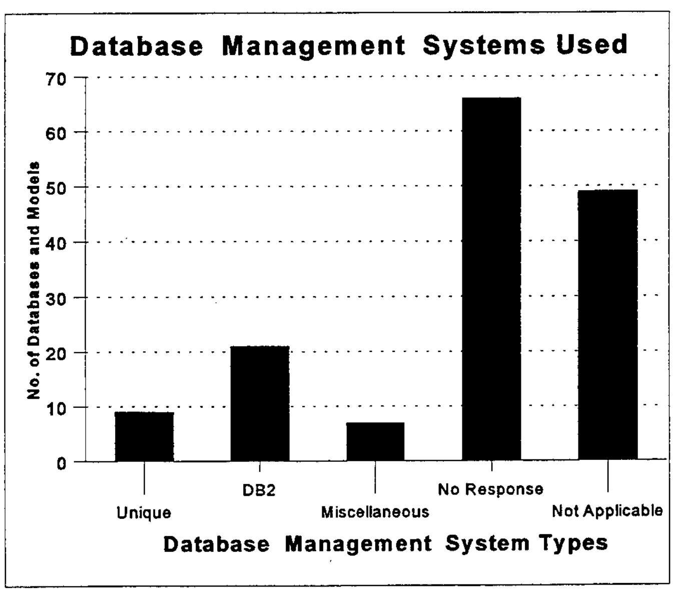

Figure 26. Preferred database management systems for the databases and models surveyed.

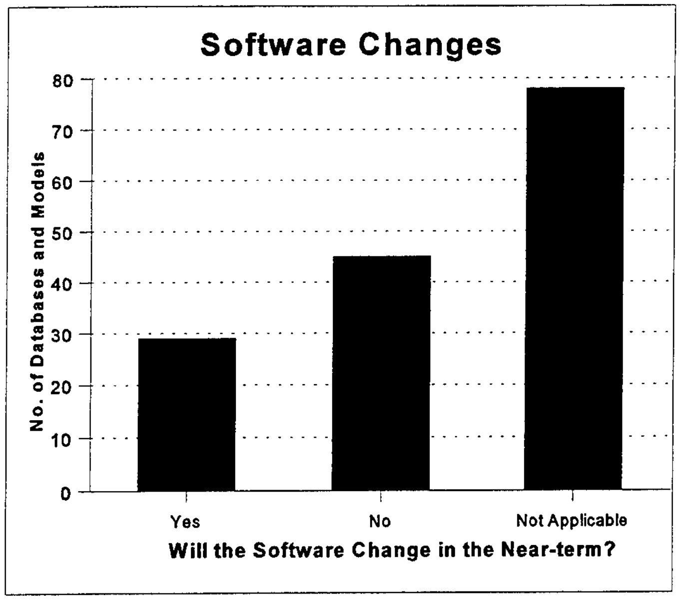

Figure 27. The number of databases and models surveyed that plan to have near-term software changes incorporated.

Questions were also asked about hardware capabilities for the models and simulations in terms of host hardware, transportability, and data media. Figures 28, 29, and 30 depict the response results.

As shown in Figure 28, generally computer workstations, personal computers, and Unisys systems are preferred as host hardware for the databases and models surveyed. Of the 74 responses for the transportability capabilities question, Figure 29 illustrates that 29 models and databases can operate on a host hardware configuration. As for data media, Figure 30 indicates that nine-track tapes, CD-ROMs, and floppy disks are predominantly used.

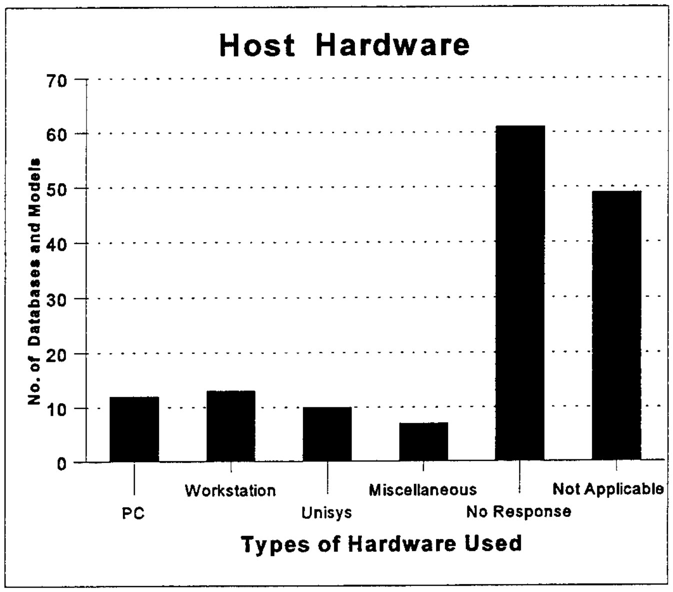

Figure 28. Types of host hardware used for the databases and models surveyed.

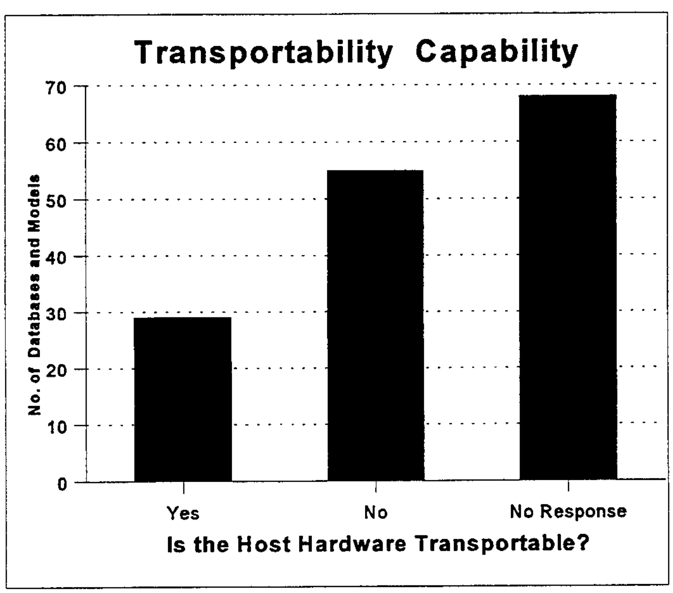

Figure 29. The number of databases and models surveyed that have transportable host hardware.

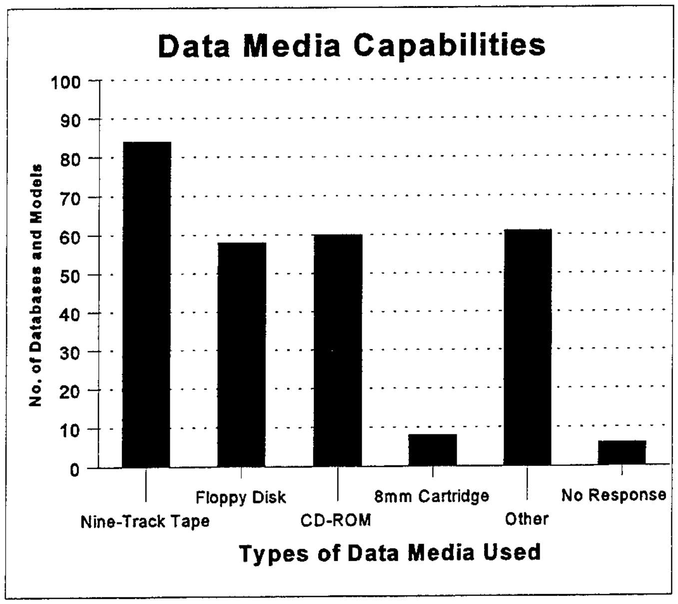

Figure 30. The types of data media used for the databases and models surveyed.

(3) **Accessibility capabilities.** Two questions were posed about accessibility capabilities associated with each model and database. The first question was concerned with the maximum information security level of the environmental data. As shown in Figure 31, 53 percent of the responses indicated that environmental data are not provided above the unclassified level. The second question was related to accessibility of the databases and models via external communications. As shown in Figure 32, unclassified phone lines are clearly the dominant external communications capability. On the other hand, about 37 percent of the databases and models do not have any type of external connectivity.

(4) **Verification, validation, and accreditation capabilities.** Questions were posed about capabilities for verification, validation, and accreditation (VV&A) of the atmospheric and near space models and databases being developed. Figure 33 provides the results of the responses to these questions. **Note that in general while a slight majority of models and databases have been verified, most of them are neither formally validated nor formally accredited.** (While VV&A deals with acceptability of a given model for a specified use, data that are input to the model undergo a similar process called verification, validation, and certification—VV&C.)

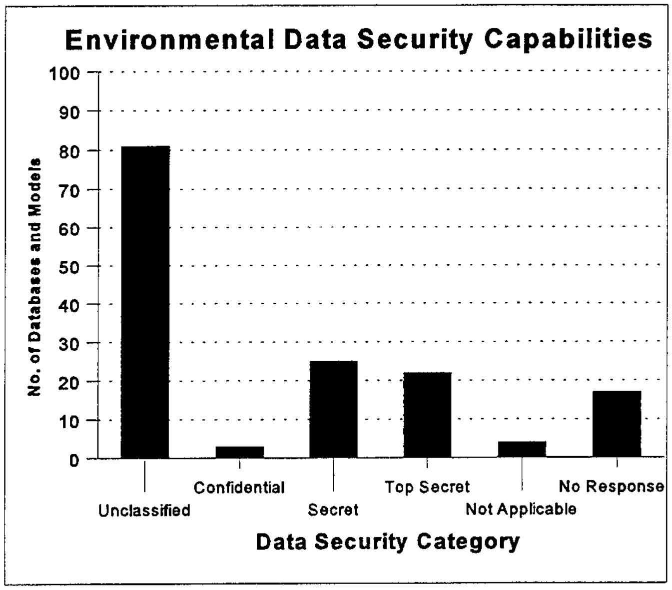

Figure 31. The maximum information security level for each of the databases and models surveyed.

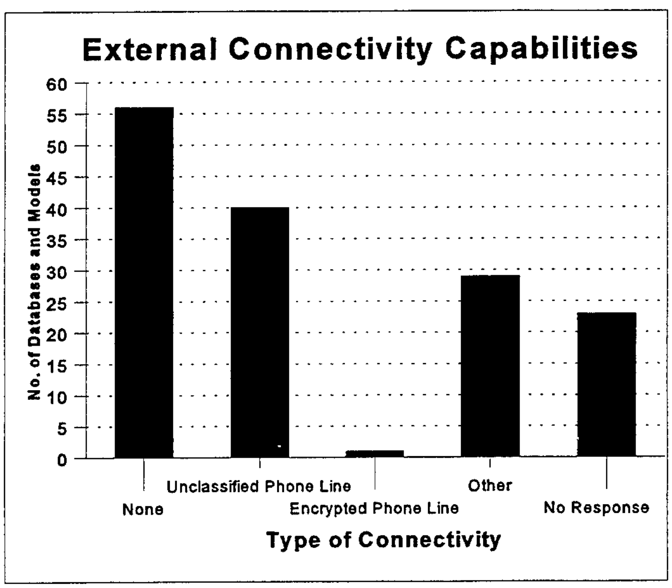

Figure 32. The types of external connectivity capabilities used for the databases and models surveyed.

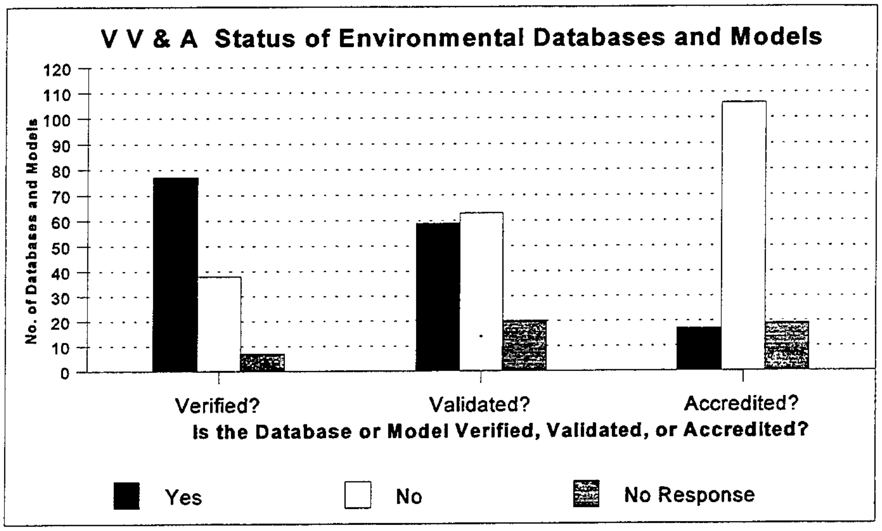

Figure 33. The number of databases and models surveyed that have been verified, validated, or accredited.

(5) **Currency of data capabilities.** A question was asked about the model or database use of reasonably current atmospheric and near space data. As shown in Figure 34, 70 percent of the models and databases use current data as input.

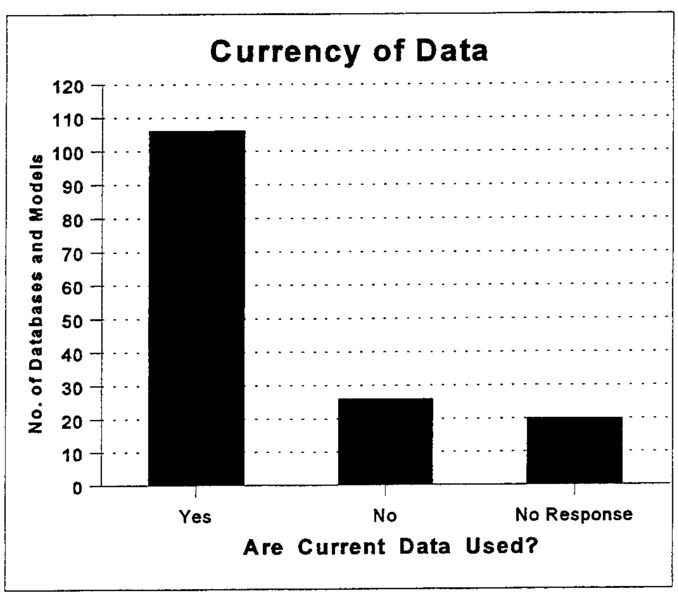

Figure 34. The number of databases and models surveyed that use reasonably current data as input.

4. SUMMARY

The purpose of the Capabilities Survey was to develop a baseline of the Military Services atmospheric and near-space-environment models and databases and environmental effects models and databases. This report, the second of three complementary reports, describes the results of the analysis of the data obtained from 152 capabilities survey questionnaires. The more significant results are briefly summarized as findings, which lead to the authors' conclusions and recommendations.

4.1 FINDINGS

All major atmospheric data and atmospheric effects are available, some in greater quantity and better quality (higher fidelity) than others. The two specific atmospheric capabilities most frequently available are transmissivity and clouds, which are available from 24 unique models and databases. Other frequently available data are temperature, wind, and radiative features, each of which is available from more than 12 models and databases. These capabilities are not redundant; the data are available across a wide range of fidelity in time and space. More than 50 percent of the models and databases provide atmospheric effects on sensors, and 25 percent of the models and databases provide atmospheric effects on military platforms. On the other hand, not even 10 percent of the surveyed models and databases have near-space-environment data capabilities.

Among the more interesting findings relating to modeling, the Survey Team observed that in the M&S hierarchy the Campaign-level models and simulations lack explicit support from the surveyed environmental models and databases. In contrast, a concentration of support is available to the one-on-one M&S hierarchical level from more than 50 percent of the environmental models and databases surveyed. Also, the vast majority (97 percent) of the surveyed models and databases support three (of six) DMSO functional areas: Research and Development, Analysis, and Military Operations. This evidence implies that the remaining functional areas (Test and Evaluation, Production and Logistics, and Education and Training) lack explicit support from the environmental models and databases surveyed.

4.2 CONCLUSIONS AND RECOMMENDATIONS

As shown in this report, the Military Services maintain a large number of unique atmospheric and atmospheric effects models and databases, and a much smaller number of near-space-environment capabilities. The Survey Team has accomplished its purpose of establishing a baseline for these capabilities, as determined from a top-down view, and of cataloging them in considerable detail. This baseline of military

environmental models and databases was compiled into the catalog shown in Appendix F, a catalog that will remain incomplete until it includes the environmental models and databases developed and maintained by civilian agencies. A follow-on survey should be conducted to augment, update, and refine the data already collected and analyzed. The survey should focus its attention on those data most needed for the DoD M&S activities as described in Burgeson et al. (1996).

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APPENDIX A

CAPABILITIES QUESTIONNAIRE

E^{2}DIS Project
Environmental Model and Database
Capabilities
Questionnaire

Administrative Information

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

A. Administrative Information

1. **Title** of Environmental Model or Database:______________________________
____

2. **General Description** of the Model or Database's Purpose:
(Alternatively, attach a 1- or 2-page existing description)
____
____
____
____
____
____

3. **Technical Expert** for the Above Model or Database

a. Rank/title, name, service: ______________________________
b. Organization title and mailing address:
____
____
____
____
____

c. Phone numbers

(1) Office:	DSN		____ - __________
	Commercial	( )	____ - __________
(2) Fax:	DSN		____ - __________
	Commercial	( )	____ - __________

d. E-mail address: ______________________________

4. **Service/Organization** Having Primary Responsibility for the Model or Database: (Circle one)

a. Army b. Navy c. Marine Corps d. Air Force e. Other (explain) ______________

5. **Organizational Location(s)** of the Environmental Model or Database: ______________
____
____

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Technical Information

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

B. Technical Information

1. **Critical Environmental Factors**

   a. What are the most critical factors, or issues, regarding the atmosphere and near space environment that have to be considered for your model or database?

____
____
____
____
____

   b. Where are these critical factors documented (e.g., identify applicable mission needs statement, statement of need, operational requirement document ______________________________________

____
____

2. **Status** of the Model or Database (Circle one and fill in the appropriate blank(s))

   a. "Operational" today; frequency of use is: _____times per day ____ times per week ____ per month
   b. Not "operational" today, but will be "operational" by FY-97
   c. None of the above (Explain: ____)

3. **Application** of the Model or Database

   a. Use in Distributed Interactive Simulation (DIS) (Circle one.)

      (1) Used in DIS today
      (2) Not used in DIS today, but planned for DIS use before FY-97
      (3) Not used in DIS today, and not planned for use in DIS before FY-97
      (4) None of the above (Explain: ____)

   b. This model or database is used for the following types of simulations:

      (Circle all that apply. Underline the predominant use.)

      (1) Constructive—Typically, classroom-setting simulations of large-scale (e.g., theater-wide) military activities.
      (2) Virtual—Forces, platforms, weapon systems, and sensors modeled in simulators and fighting on synthetic battlefields depicted by these simulators.
      (3) Live Play—Simulations using real-world forces and equipment in the field.

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

3. **Application** of the Model or Database [Continued]

c. Model or database's functional use
(Circle all that apply. Underline the one predominant category.)

(1) Education and Training
(2) Research and Development (includes Design and Engineering)
(3) Test and Evaluation (includes both DT&E and OT&E)
(4) Analysis
(5) Production and Logistics
(6) Military Operations (includes Mission Planning and Mission Rehearsal)

d. This model or database is primarily used for which simulation hierarchical category(ies)?
(Circle all that apply. Underline the one predominant category.)

(1) Campaign level	(Echelon above Corps)
(2) Mission level	(Corps/Division)
(3) Many-on-many to few-on-few level	(Combined Arms Task Force)
(4) One-on-one level	(Weapons System)
(5) Engineering level	(Weapon Subsystem Characteristics)
(6) None of the above (Explain: ________________)	

e. Types of Applications Supported: (Circle as many as apply. Underline the predominant one.)

(1) Sensor Acquisition of Targets
(2) Mobility of Platforms/Forces
(3) Decision Aids for Command and Control Authority
(4) Other (Explain): ________________________________
____

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

3. **Application** of the Model or Database [Continued]

f. Identify missions, forces, platforms, weapon systems, communications systems, sensors, and targets being simulated or modeled: (Attach additional pages, if necessary.)

(1) Missions: ______________________________

(2) Forces: ______________________________

(3) Platforms: ______________________________

(4) Weapons Systems: ______________________________

(5) Communications Systems: ______________________________

(6) Sensors:
(a) Active: ______________________________
(b) Passive: ______________________________

(7) Targets: ______________________________

g. Is there a user manual for the environmental model or database? (Circle one.)

(1) Yes (If Yes, provide title: ______________________________)
(2) No (If No, provide title of most authoritative reference: ______________________________)

h. Who is the <u>primary</u> customer for the environmental model or database?

____

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Technical Information

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

4. **Domain** of the Environmental Model or Databases

a. **Horizontal Surface** Domain (Circle all that apply and underline the predominant one.)

(1) Global (All landmasses and all oceans/seas)
(2) Global land (All landmasses, including adjacent waters)
(3) Global ocean (All ocean areas, including adjacent coastlines)
(4) Regional land (Specific land regions, including adjacent waters, e.g., western U.S. provide a list of the regions)
(5) Regional ocean (Specific ocean regions, including adjacent coastlines. e.g., eastern North Pacific. Provide a list of the regions.)
(6) Littoral (Typically, regional land areas within 650 nmi of coastline and regional ocean areas as far seaward as required. Provide a list.)
(7) Local land (Very specific land areas, including adjacent waters. e.g., Fort Irwin, CA. Provide a list.)
(8) Local ocean (Very specific ocean areas, including adjacent coastlines, e.g., southern California OPAREA. Provide a list.)
(9) Other (Explain:____________________________________)

b. **Vertical** Domain (Circle all that apply and underline the predominant one; indicate the required, specific ranges where requested.)

(1) Land surface
(2) Land subsurface Required range: Depths of ________ km to ________ km
(3) Ocean surface
(4) Ocean subsurface Required range: Depths of ________ km to ________ km
(5) Atmosphere
  (a) Near-earth (Surface to 1-km altitude) Required, specific altitude range is: ________ km to ________ km
  (b) Atmosphere (1-km to 300-km altitude) Required, specific altitude range is: ________ km to ________ km
(6) Near space (300-km to 70,000-km altitude) Required, specific altitude range is: ________ km to ________ km
(7) Other (Explain: ____________________________________)

c. **Time** Domain (Fill in the blank and circle the appropriate units of measure.)

(1) The time period typically being simulated is:
____________ minutes/hours/days/weeks/months

(2) The maximum time period that can be simulated is:
____________ minutes/hours/days/weeks/months

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

5. **Current Capabilities** of Model or Database—Capabilities that are available **Today**

a. **Grid**

(1) What type grid does the model or database typically use today? ______________________
____

(2) What type map projection does the model or database typically use today? ______________

(3) What other grid(s) and projection(s) can the model or database use? ______________________
____

b. **The following types** of **environmental data and effects** are included in this model or database today? (Circle all that apply, and complete the appropriate attachments.)

(1) Atmospheric Data and Effects—Use Attachment 1
(Surface to 300-km altitude)

(2) Near Space Data and Effects—Use Attachment 2
(300-km to 70,000-km altitude)

(3) Other Data and Effects (Identify any other types of environmental data and environmental effects that are available for model/database runs, e.g., terrain or ocean parameters, features, processes and effects.)

____
____
____

c. **Other** Technical Capabilities. Please complete Attachment 3, which describes the following technical capabilities:

(1) Scalability capabilities
(2) Compatibility capabilities
(3) Accessibility capabilities
(4) VV & A capabilities
(5) Currency capabilities

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

6. **Future Capabilities** of Environmental Model or Database—Capabilities that will be available when an upgrade to the model or database is implemented sometime in the **Future**

   a. Will this model or database be upgraded by FY-97? (Circle one.)

      (1) Yes (If Yes, proceed to the next item, 6.b.)
      (2) No (If No, proceed to item 6.c.)

   b. Briefly, explain the reason(s) for this upgrade: ________________________________

   ____

   ____

      (1) **Changes resulting from the upgrade**

         (a) List those "current capabilities" for environmental data and effects, identified in your responses to 5.a., 5.b., and 5.c. that will change as a result of the upgrade, and briefly describe how these capabilities will change quantitatively:

   ____

   ____

   ____

   ____

   ____

         (b) Why are you changing your capabilities for environmental data and effects?

   ____

   ____

      (2) **New capabilities**

         (a) List any new environmental data and environmental effects that will be available as a result of the planned upgrade:

   ____

   ____

   ____

   ____

         (b) Why are you implementing new environmental data and effects?

   ____

   ____

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

6. **Future Capabilities** of Environmental Model or Database [Continued]

   c. **Potential Value**. If there are no plans for an upgrade, would an upgrade be considered if environmental data and resulting environmental effects would be required by a simulation user? (Circle one and fill in the blank.)

      (a) Yes, for the following reason(s): ____________________
      ____

      (b) No, for the following reason(s): ____________________
      ____

7. **E^{2}DIS Project Briefing.** Would a briefing on the E^{2}DIS Project be of interest to you for your simulation support efforts? (Circle one) Yes No

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

A. Environmental Model or Database Title: ______________________________ (Fill in the blank.)

B. Vertical Domain: **Atmosphere** (including the near-earth atmosphere, i.e., surface to 300-km altitude)

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
1. Aerosols a. Cloud b. Haze c. Blowing Dust d. Volcanic Dust e. Smog	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. ___
2. Atmospheric Electricity a. Lightning b. Local Electric Field Potential	a. ___ b. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___
3. Clouds a. % Sky Coverage b. Liquid Water c. Particle Size d. Bases/Tops e. Types (1) High (2) Medium (3) Low (4) Other (Specify)	a. ___ b. ___ c. ___ d. ___ e. (1) ___ (2) ___ (3) ___ (4) ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. (1) ___ (2) ___ (3) ___ (4) ___

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

[Continued]

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
4. Dew Point	___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
5. Fog	___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
6. Humidity a. Absolute b. Relative	a. ___ b. ___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___
7. Mixing Ratio	___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

[Continued]

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
8. Precipitation a. Rate b. Type (1) Rain (2) Freezing Rain (3) Graupel (4) Hail (5) Sleet (6) Snow	a. ___ b. (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: ___________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___
9. Refractivity	___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: ___________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
10. Sea Level Pressure	___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: ___________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
11. Static Stability	___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: ___________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

[Continued]

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
12. Temperature a. Atmosphere b. Surface–Land c. Surface–Ocean	a. ___ b. ___ c. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___ c. ___
13. Trace Gases	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
14. Transmissivity	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
15. Visibility a. Horizontal b. Slant Range	a. ___ b. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

[Continued]

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
16. Winds–General a. Horizontal b. Vertical	a. ___ b. ___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___
17. Wind–Specific Features a. Fronts b. Gust Fronts c. Hurricanes/ Typhoons d. Thunderstorms e. Tornadoes/ Waterspouts f. Turbulence g. Wind Shear	a. ___ b. ___ c. ___ d. ___ e. ___ f. ___ g. ___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___ c. ___ d. ___ e. ___ f. ___ g. ___
18. Radiative Features a. Sky Brightness b. Predetermined Natural Illumination Sources (e.g., particle emissitivity) c. Local Albedo (e.g., from soil, snow cover) d. Cloud Radiance	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___ c. ___ d. ___

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

[Continued]

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
19. Smoke a. Naturally Caused b. Human Generated	a. ___ b. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___
20. Chaff Dispersion	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
21. Combat-generated Dust—Development and Dispersion	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
22. Contrail Formation and Dispersion	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___

Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

[Continued]

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
23. Dispersal of a. Biological Agents b. Chemical Agents c. Flares d. Exhaust Plumes from Terrain Vehicles e. Industrial Smoke Plumes	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: _______	a. ___ b. ___ c. ___ d. ___ e. ___
24. Nonnuclear Munitions Effects a. Explosive Shock-Induced Water Droplet Clouds b. Fireball Temperature	a. ___ b. ___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: _______	a. ___ b. ___
25. Nuclear Weapons Detonation Effects a. Enhanced Radiance b. Dispersal of X-rays and Nuclear Particles c. Movement of Shock Waves d. Winds e. Elevated Temperatures	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: _______	a. ___ b. ___ c. ___ d. ___ e. ___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Atmospheric Data**: (Check all that apply in the appropriate column.)

[Continued]

Atmospheric Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
26. Ship Exhaust Tracks (i.e., Dispersal of stack exhaust; ship wakes are not included here, since they are an ocean-embedded process)	___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Capabilities** for **Atmospheric Effects**: (Circle all that apply and fill in the appropriate blanks.)

1. Sensor Systems

a. Name of Sensor System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Particle Radiation ______ (4) Other: (Specify type and frequency band) ______ ______	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Particle Radiation ______ (4) Other: (Specify type and frequency band) ______ ______
c. Type of Sensor	(1) Active (2) Passive	(1) Active (2) Passive
d. Environmental Effects Capability	(1) Absorption (5) Refraction (2) Ducting (6) Scattering (3) Emission (7) Transmission (4) Reflection (8) Other: (Specify) ______	(1) Absorption (5) Refraction (2) Ducting (6) Scattering (3) Emission (7) Transmission (4) Reflection (8) Other: (Specify) ______
e. What line-of-sight sensor-target geometries are possible?	(1) Nadir / Near-nadir (2) Limb / Near-limb (3) Zenith / Near-zenith (4) Other: (Provide azimuth and bearings from sensor) ______	(1) Nadir / Near-nadir (2) Limb / Near-limb (3) Zenith / Near-zenith (4) Other: (Provide azimuth and bearings from sensor) ______
f. Altitude capabilities for sensor and target:	(1) Sensor altitude range is: ______ km to ______ km. (2) Target altitude range is: ______ km to ______ km.	(1) Sensor altitude range is: ______ km to ______ km. (2) Target altitude range is: ______ km to ______ km.
g. General state of the environment possible:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______ ______	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______ ______

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Capabilities** for **Atmospheric Effects**: (Circle all that apply and fill in the appropriate blanks.)

[Continued]

2. Communications Systems

a. Name of Communications System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Other: (Specify type and frequency band) ______	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Other: (Specify type and frequency band) ______
c. Environmental Effects Capabilities	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ______	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ______
d. What type of transmitter–receiver geometries are possible?	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ______ km. (b) Horizontal limit for energy path is: ______ km. (3) Other: (Describe) ______	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ______ km. (b) Horizontal limit for energy path is: ______ km. (3) Other: (Describe) ______
e. Altitude capabilities for transmitter and receiver:	(1) Transmitter altitude range is: ______ km to ______ km. (2) Receiver altitude range is: ______ km to ______ km.	(1) Transmitter altitude range is: ______ km to ______ km. (2) Receiver altitude range is: ______ km to ______ km.
f. General state of the environment possible:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Capabilities** for **Atmospheric Effects**: (Circle all that apply and fill in the appropriate blanks.)

[Continued from]

3. Weapon Systems

a. Name of Weapon System:		
b. Possible atmospheric effect(s) on the performance of the weapon system (e.g., deflection of projectiles/ ordnance ballistic trajectories due to wind):	Provide list:	Provide list:

4. Platforms

a. Name of Platform:		
b. Possible atmospheric effect(s) on the performance of the platform (e.g., ice accretion on aircraft, ships, terrain vehicles):	Provide list:	Provide list:

5. Forces

a. Type/Name of Force:		
b. Possible atmospheric effect(s) on the performance of the force (e.g., temperature effects on workload performance/combat efficiency):	Provide list:	Provide list:

6. Other

a. Type/Name of Object:		
b. Possible atmospheric effect(s) on the performance of the object:	Provide list:	Provide list:

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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

A. Model or Database Title: ______________________________ (Fill in the blank.)

B. Vertical Domain: <u>Near Space</u> (300-km to 70,000-km altitude)

C. **Capabilities** for **Near Space Data**: (Check all that apply in the appropriate column.)

Near Space <u>Data Type</u>	Model or Database <u>Currently Outputs</u> This Data Type (Place an "X" where applicable)	<u>Fidelity Capabilities</u> of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the <u>Potential to Output</u> This Data Type (Place an "X" where applicable)
1. Auroral Particle Precipitation (i.e., Energy Flux)	___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
2. Cosmic Rays	___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
3. Diffuse Zodiacal Emission a. Infrared b. Visible	a. ___ b. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___
4. Geomagnetic Field a. Strength b. Indices	a. ___ b. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___

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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities** for **Near Space Data**: (Check all that apply in the appropriate column.)

[Continued]

Near Space Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
5. Interplanetary Medium a. Interplanetary Magnetic Field (1) Strength (2) Orientation b. Solar Wind (1) Velocity (2) Density (3) Temperature c. Magnetopause Standoff Distance	a. ___ (1) ___ (2) ___ b. ___ (1) ___ (2) ___ (3) ___ c. ___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: ___________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ (1) ___ (2) ___ b. ___ (1) ___ (2) ___ (3) ___ c. ___
6. Low Energy Plasma Environment a. Ions (1) Composition (2) Number Density (3) Avg. Velocity (4) Temperature (5) Flux b. Electrons (1) Number Density (2) Vertical Profiles (3) Total Electron Content (4) Avg. Velocity (5) Temperature (6) Flux	a. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ b. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: ___________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ b. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___

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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities** for **Near Space Data**: (Check all that apply in the appropriate column.)

[Continued]

Near Space Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
7. Lunar Parameters a. Lunar Brightness b. Lunar Position	a. ___ b. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___
8. Meteoroids and Debris a. Mass b. Diameter c. Density d. Flux e. Impact Flux Size Distribution	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. ___
9. Neutral Environment a. Composition b. Density c. Temperature d. Winds	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___
10. Radio Background Noise	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___

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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Near Space Data**: (Check all that apply in the appropriate column.)

[Continued]

Near Space Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
11. Solar Parameters a. Solar Position b. Solar Radiative Flux c. Sunspot Activity d. Solar Index	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___ c. ___ d. ___
12. Star and Planetary Positions	___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___
13. Energetic Particles a. Particle Type b. Energy c. Flux d. Spatial and Temporal Distribution	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___ c. ___ d. ___
14. Geomagnetic Storms a. Magnetosphere b. Aurora c. Radiation Belts d. Spatial and Temporal Distribution	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___ c. ___ d. ___

E^{2}DIS Project
Environmental Model and Database
Capabilities
Questionnaire

Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities** for **Near Space Data**: (Check all that apply in the appropriate column.)

[Continued]

Near Space Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
15. Gravity Waves	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
16. Noctilucent Clouds	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
17. Polar Cap Absorption	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
18. Sporadic E	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___

E^{2}DIS Project
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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities for Near Space Data**: (Check all that apply in the appropriate column.)

[Continued]

Near Space Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
19. Sudden Ionospheric Storms	___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___
20. Dispersal of Flares	___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___
21. Formation and Dispersal of Rocket Exhaust	___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___
22. Munitions Effects (Nonnuclear)	___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___

E^{2}DIS Project
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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Capabilities** for **Near Space Data**: (Check all that apply in the appropriate column.)

[Continued]

Near Space Data Type	Model or Database Currently Outputs This Data Type (Place an "X" where applicable)	Fidelity Capabilities of the Model or Database (Fill in the blanks only if Column 2 is "X'd")	Model or Database Has the Potential to Output This Data Type (Place an "X" where applicable)
23. Nuclear Weapons Detonation Effects a. Elevated Temperatures b. Enhanced Radiance c. Dispersal of X-rays and Nuclear Particles d. Movement of Shock Wave e. Nuclear Heave f. Winds	a. ___ b. ___ c. ___ d. ___ e. ___ f. ___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: ___________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: _________	a. ___ b. ___ c. ___ d. ___ e. ___ f. ___

E^{2}DIS Project
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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Capabilities** for **Near Space Effects**: (Circle all that apply and fill in the appropriate blanks.)

1. Sensor Systems

a. Name of Sensor System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Particle Radiation ______ (4) Other: (Specify type and frequency band) ______ ______	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Particle Radiation ______ (4) Other: (Specify type and frequency band) ______ ______
c. Type of Sensor	(1) Active (2) Passive	(1) Active (2) Passive
d. Environmental Effects Capability	(1) Absorption (5) Refraction (2) Ducting (6) Scattering (3) Emission (7) Transmission (4) Reflection (8) Other: (Specify) ______	(1) Absorption (5) Refraction (2) Ducting (6) Scattering (3) Emission (7) Transmission (4) Reflection (8) Other: (Specify) ______
e. What line-of-sight sensor-target geometries are possible?	(1) Nadir/Near-nadir (2) Limb/Near-limb (3) Zenith/Near-zenith (4) Other: (Provide azimuth and bearings from sensor) ______	(1) Nadir/Near-nadir (2) Limb/Near-limb (3) Zenith/Near-zenith (4) Other: (Provide azimuth and bearings from sensor) ______
f. Altitude capabilities for sensor and target:	(1) Sensor altitude range is: ______ km to ______ km. (2) Target altitude range is: ______ km to ______ km.	(1) Sensor altitude range is: ______ km to ______ km. (2) Target altitude range is: ______ km to ______ km.
g. General state of the environment possible:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______ ______	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______ ______

E^{2}DIS Project
Environmental Model and Database
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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Capabilities for Near Space Effects**: (Circle all that apply and fill in the appropriate blanks.)

[Continued]

2. Communications Systems

a. Name of Communications System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Other: (Specify type and frequency band) ______ ______	(1) Acoustic ______ (2) Electromagnetic Radiation ______ (3) Other: (Specify type and frequency band) ______ ______
c. Environmental Effects Capabilities	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ______	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ______
d. What type of transmitter-receiver geometries are possible?	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ______ km. (b) Horizontal limit for energy path is: ______ km. (3) Other: (Describe) ______	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ______ km. (b) Horizontal limit for energy path is: ______ km. (3) Other: (Describe) ______
e. Altitude capabilities for transmitter and receiver:	(1) Transmitter altitude range is: ______ km to ______ km. (2) Receiver altitude range is: ______ km to ______ km.	(1) Transmitter altitude range is: ______ km to ______ km. (2) Receiver altitude range is: ______ km to ______ km.
f. General state of the environment possible:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______ ______	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorally-disturbed (b) Nuclear-disturbed (c) Other (Specify): ______ ______

E^{2}DIS Project
Environmental Model and Database
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Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Capabilities** for **Near Space Effects**: (Circle all that apply and fill in the appropriate blanks.)

[Continued]

3. Weapon Systems

a. Name of Weapon System:		
b. Possible near space effect(s) on the performance of the weapon system:	Provide list:	Provide list:

4. Platforms

a. Name of Platform:		
b. Possible near space effect(s) on the performance of the platform (e.g., drag effects on satellites):	Provide list:	Provide list:

Attachment 2: Near Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Capabilities** for **Near Space Effects**: (Circle all that apply and fill in the appropriate blanks.)

[Continued]

5. Forces

a. Type/Name of Force:		
b. Possible near space effect(s) on the performance of the force (e.g., zero gravity effects on workload performance/combat efficiency):	Provide list:	Provide list:

6. Other

a. Type/Name of Object:		
b. Possible near space effect(s) on the performance of the object:	Provide list:	Provide list:

E^{2}DIS Project
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Attachment 3: Other Capabilities

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

A. Environmental Model or Database Title: ______________________________ (Fill in the blank.)

B. Type(s) of Environmental Data / Effects:

(Circle below all the environmental data types, identified in the responses to Attachments 1 and 2, that have the same fidelity capabilities. Grouping is encouraged to minimize the number of Attachment 3 forms to be completed. Duplicate this attachment as necessary to characterize all grouped data types/effects.)

1. **Atmospheric** Data/Effects—Attachment 1:
   C. 1., 2., 3., 4., 5., 6., 7., 8., 9., 10., 11., 12., 13., 14., 15., 16., 17., 18., 19., 20., 21., 22., 23., 24., 25., 26.
   D. 1., 2., 3., 4., 5., 6.

2. **Near Space** Data/Effects—Attachment 2:
   C. 1., 2., 3., 4., 5., 6., 7., 8., 9., 10., 11., 12., 13., 14., 15., 16., 17., 18., 19., 20., 21., 22., 23.
   D. 1., 2., 3., 4., 5., 6.

C. **Other Capabilities**:

1. Scalability Capabilities

   a. Do the Model or Database's spatial grid and time interval have scaling capabilities from the baseline fidelity capabilities identified in Attachments 1 and 2?
   (Circle the appropriate answer.) Yes No

   b. If No, proceed to the next item.

   If Yes,
   (1) Briefly explain what grid and time interval scaling is possible: ______________________________
   ____
   (2) Identify any scaling capabilities for each environmental data type: ______________________________
   ____

E^{2}DIS Project
Environmental Model and Database
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Attachment 3: Other Capabilities

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

C. **Other Capabilities**:

[Continued]

2. Compatibility Capabilities

a. Software

(1) Operating System. What operating system software is used to run this model or database?

____

(2) Programming Languages. What programming languages are used ?

____

(3) Database Management System. What database management system is used ?

____

(4) Near-term Changes. Will any of these three types of software capabilities change by FY-97?
(Circle the appropriate answer.) Yes No

(a) If Yes, please identify the specific changes: ______________

____

____

____

(b) If No, proceed to the next item.

b. Hardware

(1) What host hardware system is currently used to run the model or database? ______

____

(2) Is the host hardware system transportable?
(Circle the appropriate answer.) Yes No

(3) What type(s) of data media can the system accept?
(Circle all that apply.)

(a) Nine-track Tape	(f) WORM (Specify size)
(b) Floppy Disk	(g) Floptical Disk
(c) CD-ROM	(h) Optical Tape
(d) VLDS	(i) Video Disk
(e) 8-mm Cartridge	(j) Other: (Specify) ______________

Attachment 3: Other Capabilities

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

C. **Other Capabilities**:

[Continued]

3. Accessibility Capabilities

a. Security. What is the maximum information security level of the environmental data authorized for use by the Environmental Model or Database? (Circle the appropriate answer.)
(1) Unclassified
(2) Confidential
(3) Secret
(4) Top Secret
(5) Other—Explain in unclassified terms: ____
____
____

b. Connectivity. What methods of external communications are authorized to output data? (Circle all that apply.)
(1) None
(2) Unclassified telephone (with modem) dial-up line.
(3) Encrypted telephone (with modem) dial-up line.
(4) Other—Explain briefly: ____
____

4. VV&A Capabilities

a. Verification. Has the environmental model or database been "verified" ?
(Circle one.) Yes No
(1) If Yes,
(a) Who performed the verification? ____________________
(b) To what level of detail was the verification conducted? ____________________
____
(2) If No, proceed to the next item.

b. Validation. Has the environmental model or database been "validated" ?
(Circle one.) Yes No
(1) If Yes,
(a) Who performed the validation? ____________________
(b) How was the validation conducted? ____________________
____
(2) If No, proceed to the next item.

E^{2}DIS Project
Environmental Model and Database
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Attachment 3: Other Capabilities

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

C. **Other Capabilities**:

4. VV&A Capabilities

[Continued]

c. Accreditation. Has the environmental model or database been "accredited"?
(Circle one.) Yes No

(1) If Yes,
(a) Who performed the accreditation? ____________________
(b) For what purposes was the model or database accredited? ____________________
____

(2) If No, proceed to the next item.

5. Currency of Data Capabilities

a. Does the environmental model or database use reasonably current real-world data?
(Circle one.)

(1) Yes. Briefly explain how current the data is: ____________________
____
____

(2) No. Briefly explain why current real-world data is not used: ____________________
____

APPENDIX B

SERVICE LETTERS

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE

22 DEC 1994

MEMORANDUM FOR SEE DISTRIBUTION

FROM: HQ USAF/XOW
1490 Air Force Pentagon
Washington DC 20330-1490

SUBJECT: Environmental Effects for Distributed Interactive Simulation (E^2DIS) Project Modeling & Simulation Capabilities Survey

The Defense Modeling & Simulation Office (DMSO) is sponsoring the multi-Service E^2DIS Project. One of the project's primary goals is to determine the Services' current capabilities regarding atmospheric and near-space models and databases, including environmental effects models and databases. This assessment will provide DMSO and the Services with a basis for incorporating appropriate fidelity, physics-based representations of the natural, physical environment and environmental effects into distributed interactive simulations. To help meet this goal, the E^2DIS Project Team has selected Science and Technology Corporation (STC) to survey the Services and other Government agencies.

Additional E^2DIS Project background information and a summary of the survey task is provided at attachment 2. Distribution of the results of this survey task, in the form of the products listed in attachment 2, will be made to all survey respondents once the survey data are compiled and analyzed.

Request you complete as many of the questionnaires at attachment 3 as is appropriate for the models and databases under your organization's purview. Please provide completed questionnaires by ***31 January 1995*** to:

Science and Technology Corporation
Attn: Tom Piwowar
409 Third Street, S.W.
Suite 203
Washington DC 20024

Facsimile: (202) 488-5364
Phone: (202) 863-0012

USAFETAC and AFGWC should send responses through HQ AWS/XOX. The 50 WS should send a courtesy copy of responses to their parent organization. Direct distribution to these three units has been coordinated with HQ AWS/XOX and HQ AFSPC/DOOW.

Direct any comments or questions to the Air Force point of contact, Mr. Donald Grantham, Phillips Laboratory (Hanscom AFB, MA), DSN 478-2982 or Commercial (617) 377-2982.

Thomas F. Tascione

THOMAS F. TASCIONE, Colonel, USAF
Deputy Director of Weather
DCS, Plans and Operations

Attachments:
1. Distribution List
2. E^2DIS Project and Survey Task Summary
3. Capabilities Survey Guidelines and Questionnaire

cc:
HQ USAF/XOMT

DISTRIBUTION LIST

AWS/XO

USAFETAC/DO

AFGWC/DO

HQ AFSPC/DOOW

50 WS/CC

Phillips Laboratory/GP

SAF/SS (Attn: Maj Steve Musto)

Attachment 1

Environmental Effects for Distributed Interactive Simulation (E^2DIS) Project and Survey Task Summary

The Defense Modeling and Simulation Initiative of 1 May 1992 identified the creation of synthetic environments as a major goal. Generally, synthetic environments should be capable of providing realistic information about the earth's natural, physical environment. For a synthetic environment to be "realistic," it has to simulate the actual, natural, physical environment (i.e., land, oceans, atmosphere, and near-space) properly in the time and space dimensions.

To meet this goal, the Defense Modeling and Simulation Office (DMSO) is sponsoring the joint-service E^2DIS project. The project seeks to:

a. Develop functional design requirements of an architecture that accounts for appropriate physics-based environmental effects in distributed modeling and simulation systems.

b. Develop joint-service standards for environmental data communication protocols.

c. Demonstrate "use cases" for the architecture concept and communication protocols.

d. Survey the Services to determine modeling and simulation requirements for environmental effects.

e. Survey the Services to determine environmental data base capabilities which support, or could support, the users' requirements for environmental effects.

For the E^2DIS Project, "environmental effects" is defined as the impacts, either positive or negative, that the natural, physical environment has on natural and man-made objects in the battlespace of the simulation exercise, such as a change in characteristics of the land surface, or changes in the performance of a military force/unit, platform, weapon system, or sensor. Examples are wetting of the land surface by a rain event, hindrance of troop movements due to wet soil, increased ground speed of an aircraft with a tailwind, and ducting of transmitted and returned radar energy by atmospheric trapping layers.

One of the E^2DIS project tasks calls for a survey of requirements and capabilities, and is divided into three sub-tasks:

Sub-task 1: Determine the major modeling and simulation requirements (current and anticipated) for Army, Navy, Air Force, and Marine Corps activities involving weapon systems operating in the atmosphere and near-space for environmentally realistic simulation.

Attachment 2

Sub-task 2: Identify existing environmental models and databases available to support simulation activities.

Sub-task 3: Assess the applicability of the environmental models and databases to support major modeling and simulation requirements.

The results of these sub-tasks will be published in three documents:

- The *Environment Simulation Requirements Document*
- The *Environment Model and Database Catalog*
- The *Analysis and Required New Capabilities Document*

Phillips Laboratory (Hanscom AFB MA) is managing the execution of this overall task. Representatives from Phillips Laboratory, the Army Research Laboratory (White Sands Missile Range NM) and the Naval Research Laboratory (Monterey CA) are on the Government's task team. To assist in performing the survey task, Phillips Laboratory has selected Science and Technology Corporation (STC) to develop and conduct a formal, comprehensive survey of specific Service organizations and offices.

The E^2DIS Project team manager is Dr. Harry Heckathorn, Naval Research Laboratory, Washington DC, (202) 767-4198.

Attachment 2

Environmental Effects for Distributed Interactive Simulation (E^2DIS) Project Capabilities Survey Guidelines

Survey Team. To accomplish the work associated with the survey task, the E^2DIS Project has selected Science and Technology Corporation (STC) to interface with the Services and other Government agencies. STC Survey Team members include: Dr. Paul Try, Mr. John Burgeson, Mr. Ken Eis, Mr. Carl Chesley, Mr. Jerry Johnson, Mr. Paul Cooper, and Mr. Tom Piwowar.

Survey Procedure.

a. Make copies of the questionnaire available to your organizations' technical points of contact.

b. Complete and forward questionnaires to arrive by the suspense date.

c. Forward completed questionnaires to:

Science and Technology Corporation
Attn: Tom Piwowar
409 Third Street, S.W.
Suite 203
Washington DC 20024

Facsimile: (202) 488-5364
Phone: (202) 863-0012

d. The Survey Team will review the returned questionnaires and enter the data in the Project database.

e. On a case-by-case basis, Survey Team members will conduct follow-up telephonic and in-person interviews with technical points-of-contact to clarify questionnaire responses.

Government Point-of-Contact. The Air Force representative and leader for the E^2DIS Project survey task is:

Mr. Donald Grantham
Phillips Laboratory (Hanscom AFB MA)
Phone: (617) 377-2982 or DSN 478-2982
Facsimile: (617) 377-2984

Notify Mr. Grantham of any issues that arise during the execution of this survey effort.

Attachment 3

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR INTELLIGENCE
WASHINGTON, DC 20310-1001

REPLY TO
ATTENTION OF

DAMI-POB (70-1p)

3 January 1995

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Survey to Identify Existing Environmental Models and Data Bases used to Support Simulation Activities

1. Request you complete Enclosure 3 survey for each environmental model or data base you use to support simulations activities. Submit completed surveys by 30 January 1995 directly to the supporting contractor: Science and Technology Corporation, ATTN: Tom Piowar, 409 Third Street, SW, Suite 203, Washington, DC 20024, PH: (202) 863-0012, FAX: (202) 488-5364.

2. HQDA, DAMI-POB serves on the Executive Advisory Committee for the Defense Modeling and Simulations Office (DMSO) sponsored multi-Service Environmental Effects Distributed Interactive Simulations (E^2DIS) project, which is linking together several Services research efforts into a single interactive simulation. One of the tasks listed in the Project Development Plan is to conduct a survey to establish a baseline of information about how environmental effects are currently being used in simulations. Your accurate description in the Enclosure 3 survey will be of great assistance to them, and we ask you full cooperation. Additional information about the E^2DIS project is at Enclosures 1 and 2.

3. If you have questions contact the technical advisor, Dr. Richard Shirkey, Army Research Laboratory, Battlefield Environment Directorate (ARL/BED), ATTN: AMSRL-BE-S, White Sands Missile Range, NM 88002-5501, DSN 258-5470, or COM (505) 678-5470.

4. Please fill out a separate questionnaire for each data base or model your organization uses to support an Army simulation activity in order to determine current capabilities regarding support for simulations, including atmosphere and near-space models. DMSO will use your answers to develop the right fidelity and physics in the E^2DIS project.

5. HQDA, DAMI-POB point of contact is Mr. Lee Page, DSN 225-5509.

FOR THE DIRECTOR OF INTELLIGENCE POLICY AND OPERATIONS:

JOHN E. GENTRY
Colonel, GS
Chief, DAMI-POB

DAMI-POB (70-1p)
SUBJECT: Survey to Identify Existing Environmental Models and Data Bases used to Support Simulation Activities

DISTRIBUTION:

DIRECTOR
U.S. ARMY RESEARCH LABORATORY, BATTLEFIELD ENVIRONMENT DIRECTORATE, ATTN: AMSRL-BE, WHITE SANDS MISSILE RANGE, NM 88002-5501
U.S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, ATTN: CECRL-TD, 72 LYME ROAD, HANOVER, NH 03755-1290
U.S. ARMY TOPOGRAPHIC CENTER, ATTN: CETEC-GL, FORT BELVOIR, VA 22060-5546
U.S. ARMY WATERWAYS EXPERIMENT STATION. ATTN: CEWES-CD, 3909 HALLS FERRY ROAD, VICKSBURG, MS 19180-6199
COMMANDER
U.S. ARMY COMBINED ARMS CENTER, ATTN: ATZL-CAW, FORT LEAVENWORTH, KS 66027-5300
USAFETAC/CC, 859 BUCHANAN ROAD, SCOTT AFB, IL 62225-5116

CF:
DIRECTOR, U.S. ARMY MODEL AND SIMULATION OFFICE, 1725 JEFFERSON DAVIS HIGHWAY. CRYSTAL SQ II, SUITE 808, ARLINGTON, VA 22202-5000
SCIENCE AND TECHNOLOGY CORPORATION, ATTN: MR. TOM PIOWAR, 409 THIRD ST, SW, SUITE 203, WASHINGTON DC, 20024

Environmental Effects for Distributed Interactive Simulation

(E^2DIS)

Project and Survey Task Summary

E^2DIS. The Defense Modeling and Simulation Initiative of 1 May 1992 identified the creation of synthetic environments as a major goal. Generally, synthetic environments should be capable of providing realistic information about the earth's natural, physical environment. For a synthetic environment to be "realistic," it has to simulate the actual, natural, physical environment (i.e., land, oceans, atmosphere, and near-space) properly in the time and space dimensions (i.e., in the horizontal and vertical).

In recognition of this major goal, as well as the magnitude and complexity of the work needed to achieve the goal, the Defense Modeling and Simulation Office (DMSO) is supporting a joint-service project entitled "Environmental Effects for Distributed Interactive Simulation (E^2DIS)." The E^2DIS project seeks to:

1. Develop functional design requirements of an architecture that accounts for appropriate physics-based environmental effects in distributed modeling and simulation systems.
2. Develop joint-service standards for environmental data communication protocols.
3. Demonstrate "use cases" for the architecture concept and communication protocols.
4. Survey the Services to determine modeling and simulation requirements for environmental effects.
5. Survey the Services to determine environmental data base capabilities which support, or could support, the users' requirements for environmental effects.

For the E^2DIS Project, "environmental effects" is defined as the impacts, either positive or negative, that the natural, physical environment has on natural and man-made objects in the battlespace of the simulation exercise, such as a change in characteristics of the land surface, and changes in the performance of a military force/unit, platform, weapon system, or sensor. Examples are wetting of the land surface by a rain event; hindrance of troop movements due to wet soil; increased ground speed of an aircraft with a tailwind; and ducting of transmitted and returned radar energy by atmospheric trapping layers.

A Memorandum of Agreement establishes the working relationship between DMSO and the E^2DIS project team. A Program Development Plan (PDP) describes how the E^2DIS goals will be achieved. Eight task areas are defined and detailed descriptions are provided to show how each of these tasks will be executed.

Project team manager for the E^2DIS Project is Dr. Harry Heckathorn, Naval Research Laboratory, Washington, D.C., (202) 767-4198.

Enclosure 1

E^2DIS Project

Task 5. Task 5 of the E^2DIS project is the Survey of Requirements and Capabilities task, which is divided into three sub-tasks:

Sub-task 1: Determines the major modeling and simulation requirements (current and anticipated) for Army, Navy, Air Force and Marine Corps activities involving weapon systems operating in the atmosphere and near-space for environmentally realistic simulation.

Sub-task 2: Identifies existing environmental models and databases available to support simulation activities.

Sub-task 3: Assesses the applicability of the environmental models and databases to support major modeling and simulation requirements.

The results of these sub-tasks will be published in three documents:

- The *Environment Simulation Requirements Document*
- The *Environment Model and Database Catalog*
- The *Analysis and Required New Capabilities Document*

Management-wise, the Air Force's Phillips Laboratory (Hanscom Air Force Base, Massachusetts) is the lead activity for executing this task. Representatives from Phillips Laboratory, the Army Research Laboratory (White Sands Missile Range, New Mexico) and the Naval Research Laboratory (Monterey, California) comprise the Government's Task 5 Team. To assist in performing the survey task, Phillips Laboratory has selected Science and Technology Corporation (STC) to develop and conduct a formal, comprehensive survey of specific Service organizations and offices.

Enclosure 1

Environmental Effects for Distributed Interactive Simulation

(E^2DIS) Project

Capabilities Survey Guidelines

Survey Team. To accomplish the work associated with the Survey Task, the E^2DIS Project has selected Science and Technology Corporation (STC) to interface with the Services and other Government agencies. STC Survey Team members include: Dr. Paul Try, John Burgeson, Ken Eis, Carl Chesley, Jerry Johnson, Paul Cooper, and Tom Piwowar.

Survey Procedure.

1. Your organization receives a tasking letter or memorandum originated within your Service (A copy of the Capabilities Questionnaire is attached). Copies of the questionnaire are made available to your organizations' technical points-of-contact.
2. Questionnaires are completed by the suspense date.
3. Completed questionnaires are forwarded to:

   Science and Technology Corporation
   Attn: Tom Piwowar
   409 Third Street, S.W.
   Suite 203
   Washington, D.C. 20024

   Facsimile: (202) 488-5364
   Phone: (202) 863-0012
4. Survey Team reviews the returned questionnaires and enters the data in the Project's database.
5. On a case-by-case basis, Survey Team members conduct follow-up telephonic and in-person interviews with technical points-of-contact to clarify questionnaire responses.

Government Point-of-Contact. The Army representative for the E^2DIS Project's Survey Task is:

Dr. Richard Shirkey
Army Research Laboratory
White Sands Missile Range, New Mexico

Phone: (505) 678-5470 or DSN 258-5470
Facsimile: (505) 678-8366

Dr. Shirkey should be notified of any issues that might arise during the execution of this survey.

Enclosure 2

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

3140
961/ 5U573020
17 Jan 95

From: Chief of Naval Operations (N096)

Subj: ENVIRONMENTAL EFFECTS FOR DISTRIBUTED INTERACTIVE SIMULATION (E^2DIS) PROJECT MODELING & SIMULATION CAPABILITIES SURVEY

Encl: (1) E^2DIS Project and Survey Task Summary
(2) Capabilities Survey Guidelines and Questionnaire

1. The Defense Modeling & Simulation Office (DMSO) is sponsoring the multi-service E^2DIS Project. One of the project's key goals is to determine the Services' current capabilities regarding atmospheric and near-space models and databases, including environmental effects models and databases. This assessment will provide DMSO and the services with a basis for incorporating appropriate fidelity, physics-based representations of the natural, physical environment and environmental effects into distributed interactive simulations. To assist in achieving this goal, the E^2DIS Project Team has selected Science and Technology Corporation (STC) to survey the services and other government agencies. Enclosure (1) provides additional E^2DIS Project background information and a summary of the survey task.

2. Enclosure (2) contains information on how the survey will be conducted and the capabilities questionnaire. Request you support STC with this survey of your organization by completing as many questionnaires as are appropriate for the models and databases under your organization's cognizance. Please provide completed questionnaires by 17 February 1995 to the following:

Science and Technology Corporation
Attn: Tom Piwowar
409 Third Street, S.W.
Suite 203
Washington, D.C. 20024

Facsimile: (202) 488-5364
Phone: (202) 863-0012

3. Your response and accurate completion of these capabilities questionnaires are imperative, for they will establish the data base for modeling and simulation requirements, including the atmosphere and near-space environments and environmental effects. The results

Subj: ENVIRONMENTAL EFFECTS FOR DISTRIBUTED INTERACTIVE SIMULATION (E^2DIS) PROJECT MODELING & SIMULATION CAPABILITIES SURVEY

of this survey effort, in the form of the products listed in enclosure (1), will be available to all survey respondents once the survey data is compiled and analyzed.

4. If you have any comments or questions, the N096 point-of-contact is CDR Terry Tielking, N961E, COMM (202) 653-1616/DSN 294-1616 and the Navy E^2DIS point-of-contact is Mr. Sam Brand, Naval Research Laboratory, Monterey, CA, COMM (408) 656-4748/DSN 878-4748.

K.W. Foster

K. W. FOSTER
Oceanographer of the Navy
Acting

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NAVUNSEAWARCENDET New London, CT
NAVUNSEAWARCENDIV Newport, RI
NAVUNSEAWARCENDIV Keyport, WA
NCCOSC San Diego, CA
COMINTICEPAT Groton, CT

Subj: ENVIRONMENTAL EFFECTS FOR DISTRIBUTED INTERACTIVE SIMULATION (E^2DIS) PROJECT MODELING & SIMULATION CAPABILITIES SURVEY

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Environmental Effects for Distributed Interactive Simulation

(E^2DIS)

Project and Survey Task Summary

<u>E^2DIS</u>. The Defense Modeling and Simulation Initiative of 1 May 1992 identified the creation of synthetic environments as a major goal. Generally, synthetic environments should be capable of providing realistic information about the earth's natural, physical environment. For a synthetic environment to be "realistic," it has to simulate the actual, natural, physical environment (i.e., land, oceans, atmosphere, and near-space) properly in the time and space dimensions (i.e., in the horizontal and vertical).

In recognition of this major goal, as well as the magnitude and complexity of the work needed to achieve the goal, the Defense Modeling and Simulation Office (DMSO) is supporting a joint-service project entitled "Environmental Effects for Distributed Interactive Simulation (E^2DIS)." The E^2DIS project seeks to:

1. Develop functional design requirements of an architecture that accounts for appropriate physics-based environmental effects in distributed modeling and simulation systems.
2. Develop joint-service standards for environmental data communication protocols.
3. Demonstrate "use cases" for the architecture concept and communication protocols.
4. Survey the Services to determine modeling and simulation requirements for environmental effects.
5. Survey the Services to determine environmental data base capabilities which support, or could support, the users' requirements for environmental effects.

For the E^2DIS Project, "environmental effects" is defined as the impacts, either positive or negative, that the natural, physical environment has on natural and man-made objects in the battlespace of the simulation exercise, such as a change in characteristics of the land surface, and changes in the performance of a military force/unit, platform, weapon system, or sensor. Examples are wetting of the land surface by a rain event; hindrance of troop movements due to wet soil; increased ground speed of an aircraft with a tailwind; and ducting of transmitted and returned radar energy by atmospheric trapping layers.

A Memorandum of Agreement establishes the working relationship between DMSO and the E^2DIS project team. A Program Development Plan (PDP) describes how the E^2DIS goals will be achieved. Eight task areas are defined and detailed descriptions are provided to show how each of these tasks will be executed.

Project team manager for the E^2DIS Project is Dr. Harry Heckathorn, Naval Research Laboratory, Washington, D.C., (202) 767-4198.

Enclosure (1)

E^2DIS Project

Task 5. Task 5 of the E^2DIS project is the Survey of Requirements and Capabilities task, which is divided into three sub-tasks:

Sub-task 1: Determines the major modeling and simulation requirements (current and anticipated) for Army, Navy, Air Force and Marine Corps activities involving weapon systems operating in the atmosphere and near-space for environmentally realistic simulation.

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Sub-task 3: Assesses the applicability of the environmental models and databases to support major modeling and simulation requirements.

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Management-wise, the Air Force's Phillips Laboratory (Hanscom Air Force Base, Massachusetts) is the lead activity for executing this task. Representatives from Phillips Laboratory, the Army Research Laboratory (White Sands Missile Range, New Mexico) and the Naval Research Laboratory (Monterey, California) comprise the Government's Task 5 Team. To assist in performing the survey task, Phillips Laboratory has selected Science and Technology Corporation (STC) to develop and conduct a formal, comprehensive survey of specific Service organizations and offices.

Environmental Effects for Distributed Interactive Simulation

(E^2DIS) Project

Capabilities Survey Guidelines

Survey Team. To accomplish the work associated with the Survey Task, the E^2DIS Project has selected Science and Technology Corporation (STC) to interface with the Services and other Government agencies. STC Survey Team members include: Dr. Paul Try, John Burgeson, Ken Eis, Carl Chesley, Jerry Johnson, Paul Cooper, and Tom Piwowar.

Survey Procedure.

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4. Survey Team reviews the returned questionnaires and enters the data in the Project's database.
5. On a case-by-case basis, Survey Team members conduct follow-up telephonic and in-person interviews with technical points-of-contact to clarify questionnaire responses.

Government Point-of-Contact. The Navy and Marine Corps representative for the E^2DIS Project's Survey Task is:

Mr. Sam Brand
Naval Research Laboratory
Monterey, CA

Phone: (408) 656-4748 or DSN 878-4748
Facsimile: (408) 656-4769

Mr. Brand should be notified of any issues that might arise during the execution of this survey.

Enclosure (2)

APPENDIX C

DESCRIPTION OF THE CAPABILITIES DATABASE

C.1. STRUCTURE OF DATABASE TABLES

As briefly discussed in Section 2.2.5.1 of the text each database table contains relational information and a common field that allows the tables to be linked together. The primary method of linking various database tables is through the use of an arbitrary, but unique, number assigned to each questionnaire received. Each record (row), or group of records, in a table corresponds to a specific questionnaire; each field (column) corresponds to a specific response, or entry, from a questionnaire. In keeping with sound relational database development theory and practice, the database tables are small in terms of the number of fields. No table has more than 18 fields, and most tables have 10 or less.

Specific items in the Capabilities Questionnaire have been associated with, or mapped into, 23 *Paradox for Windows* database tables. In Table 1 these items are listed and are associated with the appropriate database table. Note that Table 1 is a summary, organized according to the sequence of items in the Capabilities Questionnaire. It also provides reference to Section C.2. in this appendix, where each database table and field is described in detail.

Table 1. Summary of Capabilities Questionnaire Database Tables

Questionnaire Sections (Appendix A)	Database Table Title	Section C.2. Description Paragraph
Items A.1., A.2., A,4., and A.5.	ADMINCAP.DB	C.2.1.
Item A.3.	EXPERTCAP.DB	C.2.2.
Items B.1., B.2., B.3.g., B.4., and B.5.a.	TECHCAP.DB	C.2.3.
Items B.3.a.–B.3.f.	APPLICAP.DB	C.2.4.
Item B.5.b.(1) Attachment 1, Items C.1.–C.26. (columns 1–3)	CFADECAP.DB	C.2.5.
Item B.5.b.(2) Attachment 2, Items C.1.–C.23. (columns 1–3)	CFNSDCAP.DB	C.2.6.
Item B.5.b.(3)	OTHDECAP.DB	C.2.7.
Item B.5.c. Attachment 3, Items C.1.–C.5.	OTHECAP.DB	C.2.8.
Items B.6.a., B.6.b., and B.6.c. Item B.7.	FUTURCAP.DB	C.2.9.

Table 1. **Summary of Capabilities Questionnaire Database Tables (Continued)**

Questionnaire Sections (Appendix A)	Database Table Title	Section C.2. Description Paragraph
Attachment 1, Items C.1.–C.26. (columns 1 and 4) Attachment 2, Items C.1.–C.23. (columns 1 and 4)	PDATACAP.DB	C.2.10.
Attachment 1, Item D.1.	CAE_SNSR.DB	C.2.11.
Attachment 1, Item D.2.	CAE_COMM.DB	C.2.12.
Attachment 1, Item D.3.	CAE_WEAP.DB	C.2.13.
Attachment 1, Item D.4.	CAE_PLAT.DB	C.2.14.
Attachment 1, Item D.5.	CAE_FORC.DB	C.2.15.
Attachment 1, Item D.6.	CAE_OTHR.DB	C.2.16.
Attachment 2, Item D.1.	CNSDE_SN.DB	C.2.17.
Attachment 2, Item D.2.	CNSDE_CM.DB	C.2.18.
Attachment 2, Item D.3.	CNSDE_WS.DB	C.2.19.
Attachment 2, Item D.4.	CNSDE_PL.DB	C.2.20.
Attachment 2, Item D.5.	FNSDE_FO.DB	C.2.21.
Attachment 2, Item D.6.	RNSDE_OB.DB	C.2.22.
Attachment 3, Items B.1. and B.2.	SAMEFDLC.DB	C.2.23.

C.2. DESCRIPTION OF DATABASE TABLES

Each of the 23 database tables is described in detail. The pages and items that are indicated refer to those of the Capabilities Questionnaire.

C.2.1. ADMINCAP.DB. Items A.1., A.2., A.4., and A.5. pertain to ADMINistrative information. Note that Item A.3., the item on Technical Expert, is not included in this database table but is associated with a separate database table (i.e., EXPERT.DB), described in the next paragraph. The first field in ADMIN.DB, the model tracking number, is keyed to and has referential integrity with a similar field in all other database tables except EXPERT.DB. The technical expert may not be unique for each model; in any case, ADMIN.DB and EXPERT.DB can be linked by the last name and first name fields. A description of each

field for this database table follows; this table is the "parent" to the other ("children") tables. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the model tracking number uniquely assigned to the returned questionnaire.

Field 2 (A.1.) is the title for the simulation model.

Field 3 (A.2.) is the general description of the model.

Field 4 (A.3.a.) is the last name of the technical expert (the same entry as Field 1 in EXPERT.DB).

Field 5 (A.3.a.) is the first name of the technical expert (the same entry as Field 2 in EXPERT.DB).

Field 6 (A.4.) is the service/organization responsible for the model.

Field 7 (A.5.) is the organizational location of the model.

Field 8 is the date the returned questionnaire was received.

C.2.2. EXPERT.DB. Items A.3.a. through A.3.d. are related to the technical EXPERT identified for the simulation model. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 (A.3.a.) is the last name of the technical expert and the first part of the composite key (the same entry as Field 4 in ADMINCAP.DB).

Field 2 (A.3.a.) is the first name of the technical expert and the second part of the composite key (the same entry as Field 5 in ADMINCAP.DB).

Field 3 (A.3.a.) is the middle initial of the technical expert.

Field 4 (A.3.a.) is the rank/title of the technical expert.

Field 5 (A.3.b.) is the organizational title.

Field 6 (A.3.b.) is the first line of the organizational mailing address.

Field 7 (A.3.b.) is the second line of the organizational mailing address.

Field 8 (A.3.b.) is the city of the organizational mailing address.

Field 9 (A.3.b.) is the state of the organizational mailing address.

Field 10 (A.3.b.) is the organization's ZIP code.

Field 11 (A.3.c.(1)) is the office DSN phone number.

Field 12 (A.3.c.(1)) is the office commercial phone number.

Field 13 (A.3.c.(2)) is the office DSN fax number.

Field 14 (A.3.c.(2)) is the office commercial fax number.

Field 15 (A.3.d.) is the E-mail address.

C.2.3. TECHCAP.DB. Items B.1., B.2., B.3.g., B.3.h, B.4., and B.5.a. provide TECHnical CAPabilities information on the model or database. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the keyed (unique) model tracking number.

Field 2 (B.1.a.) describes the most critical environmental issues considered for the model or database.

Field 3 (B.1.b.) describes where these issues are documented.

Field 4 (B.2.) describes the status of the model or database.

Field 5 (B.3.g.) describes the user manual for the model or description of the database, if either is available.

Field 6 (B.3.h.) identifies the primary customer for the model or database.

Field 7 (B.4.a.) describes the primary horizontal surface domain.

Field 8 (B.4.a.) describes the secondary horizontal surface domain.

Field 9 (B.4.b.) describes the primary vertical surface domain.

Field 10 (B.4.b.) describes the secondary vertical surface domain.

Field 11 (B.4.c.(1)) is the typical time period being simulated.

Field 12 (B.4.c.(2)) is the maximum time period being simulated.

Field 13 (B.5.a.(1)) is the type of grid simulation typically used today by the simulation model.

Field 14 (B.5.a.(2)) is the type of map projection typically used today.

Field 15 (B.5.a.(3)) describes other types of grids and map projections.

C.2.4. APPLICAP.DB. Items B.3.a.–B.3.f. provide information on the APPLIcation CAPabilities of the database or model. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the unique model tracking number.

Field 2 (B.3.a.) describes use in DIS.

Field 3 (B.3.b.) contains the predominant type of simulation.

Field 4 (B.3.b. continued) contains any of the two other types of simulation, if listed.

Field 5 (B.3.c.) contains the predominant of up to six functional uses.

Field 6 (B.3.c. continued) contains the other functional uses (if any).

Field 7 (B.3.d.) contains the predominant of up to five hierarchical levels.

Field 8 (B.3.d. continued) contains the remaining hierarchical levels, if any.

Field 9 (B.3.e.) contains the predominant of up to four types of applications supported.

Field 10 (B.3.e. continued) contains the remaining types of applications supported, if any.

Field 11 (B.3.f.(1)) describes the mission being simulated or modeled.

Field 12 (B.3.f.(2)) describes the forces being simulated or modeled.

Field 13 (B.3.f.(3)) describes the platforms being simulated or modeled.

Field 14 (B.3.f.(4)) describes the weapons systems being simulated or modeled.

Field 15 (B.3.f.(5)) describes the communications systems being simulated or modeled.

Field 16 (B.3.f.(6a)) describes the active sensors being simulated or modeled.

Field 17 (B.3.f.(6b)) describes the passive sensors being simulated or modeled.

Field 18 (B.3.f.(7)) describes the targets being simulated or modeled.

C.2.5. CFADECAP.DB. Item B.5.b.(1), Current Fidelity Atmospheric Data and Effects CAPabilities, refers to Attachment 1, Items C.1.–C. 26., to identify specific atmospheric data types. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the unique tracking number.

Field 2 (Attachment 1, Item C., column 1) is a keyed (unique) data type. Hence, Fields 1 and 2 make up a composite key. Entries in Field 2 are taken directly from the 26 data types listed in column 1, e.g., low clouds would be entered as 3.e.(3). Thus, each required data type is a unique entry. The following seven fields are associated with each unique data type entry.

Field 3 (first entry of column 3 of Attachment 1, Item C.) is the required horizontal grid spacing.

Field 4 (second entry of column 3 of Attachment 1, Item C.) is the required vertical grid spacing.

Field 5 (third entry of column 3 of Attachment 1, Item C.) is the required time resolution.

Field 6 (fourth entry of column 3 of Attachment 1, Item C.) is the unit of measure for the data type.

Field 7 (first bullet under the fourth entry of column 3 of Attachment 1, Item C.) is the required minimum range.

Field 8 (first bullet under the fourth entry of column 3 of Attachment 1, Item C) is the required maximum range.

Field 9 (second bullet under the fourth entry of column 3 of Attachment 1, Item C) is the required accuracy.

C.2.6. CFNSDCAP.DB. Item B.5.b.(2), Current Fidelity of Near Space Data Capabilities, refers to Attachment 2, Items C.1.–C.23. to identify specific near-space-environment data types. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the unique tracking number.

Field 2 (Attachment 2, Item C, column 1) is a keyed (unique) data type. Hence, Fields 1 and 2 make up a composite key. Entries in Field 2 are taken directly from the 23 data types listed in column 1, e.g., the geomagnetic field strength would be entered as 4.a. Thus, each required near space data type is a separate entry, and the remaining seven fields are associated with it.

Field 3 (Attachment 2, Item C, column 3) is the horizontal grid spacing in meters.

Field 4 (Attachment 2, Item C, column 3) is the vertical grid spacing in meters.

Field 5 (Attachment 2, Item C, column 3) is the required time resolution.

Field 6 (Attachment 2, Item C, column 3) is the unit of measure for the data type.

Field 7 (Attachment 2, Item C, column 3) is the required minimum range.

Field 8 (Attachment 2, Item C, column 3) is the required maximum range.

Field 9 (Attachment 2, Item C, column 3) is the required accuracy.

C.2.7. OTHDECAP.DB. Item B.5.c. provides information on currently required environmental data and environmental effects not covered by items in Attachments 1 and 2 (that is, OTHer Data and Effects CAPabilities). A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the unique model tracking number.

Field 2 (B.5.b.(3)) describes any other required environmental data and/or effects not covered by items in Attachments 1 and 2.

C.2.8. OTHTECAP.DB. Item B.5.c. Attachment 3, Item C. provide information on the OTHer TEchnical CAPabilities. It refers to the grouping of environmental data types identified in Attachment 1, Items C. and D., and the capabilities in Item C. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 (Attachment 3, A.) is the unique tracking number.

Field 3 (Attachment 3, C.1.a.) describes unique scalability capabilities.

Field 4 (Attachment 3, C.2.a.(1)) describes the operating system software compatibility capabilities.

Field 5 (Attachment 3, C.2.a.(2)) describes the programming language compatibility capabilities.

Field 6 (Attachment 3, C.2.a.(3)) describes the database management system software compatibility capabilities.

Field 7 (Attachment 3, C.2.a.(4)) describes the near-term software capabilities changes.

Field 8 (Attachment 3, C.2.b.(1)) describes the hardware system compatibility capabilities.

Field 9 (Attachment 3, C.2.b.(2)) describes whether the hardware system is transportable.

Field 10 (Attachment 3, C.2.b.(3)) describes the data media the system can accept.

Field 11 (Attachment 3, C.3.a.) describes the accessibility with respect to security.

Field 12 (Attachment 3, C.3.b.) describes the accessibility with respect to connectivity capabilities.

Field 13 (Attachment 3, C.4.a.) describes the verification capabilities.

Field 14 (Attachment 3, C.4.b.) describes the validation capabilities.

Field 15 (Attachment 3, C.4.c.) describes the accreditation capabilities.

Field 16 (Attachment 3, C.5.) describes the currency capabilities.

C.2.9. FUTURCAP.DB. Items B.6 and B.7 relate to any changes to current and FUTURre CAPabilities resulting from a planned model or database upgrade. These items are also used to discuss whether an upgrade would be considered if currently unavailable environmental data or effects could be provided. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the unique model tracking number.

Field 2 (B.6.b.) describes either the reason for model upgrade or states that none is planned.

Field 3 (B.6.b.(1)(a)) describes the changes to "current capabilities," i.e., those identified in other tables.

Field 4 (B.6.b.(1)(b)) describes the reasons for the changes to "current capabilities."

Field 5 (B.6.b.(2)(a)) describes the new environmental data and effects (ED&E) required as a result of the upgrade and the ED&E whose availability might result in stimulating an upgrade.

Field 6 is a response to either (B.6.b.(2)(b)), a description of the reasons for the new capabilities; or (B.6.c.), a discussion of the potential value of acquiring presently unavailable environmental data or effects.

Field 7 (B.7.) contains the response to an offer to provide a briefing on atmospheric/near-space-environment data and effects.

C.2.10. PDATACAP.DB. Attachments 1 and 2, column 4 of Item C., Potential DATA CAPabilities for specific types. This database table includes both atmospheric (Attachment 1) and near-space (Attachment 2)-environment data capabilities. Data already accounted for in CFADECAP.DB is *not* included here. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the unique tracking number.

Field 2 (Attachment 1, Item C., column 4) is entered with descriptions of any of the 26 atmospheric data types listed in column 1 that have potential for being future capabilities. For example, if there is potential future capabilities for such atmospheric data as blowing dust, fog, rain, and snow, the entry would be 1.c., 5., 8.b.(1), and 8.b.(6).

Field 3 (Attachment 2, Item C., column 4) is entered with descriptions of the near space data types listed in column 1. For example, if there is potential future capabilities for near space data and effects such as diffuse zodiacal infrared emissions, interplanetary solar wind velocity, and meteoroid mass and density, the entry would be 3.a., 5.b.(1), 8.a., and 8.c.

C.2.11. CAE_SNSR.DB. Attachment 1, Item D.1. provides information on the Capabilities for Atmospheric Effects for SeNSoR systems. The database table fields are the same as columns 1 and 2 of Item D.1. If more than one sensor system is described, additional sets of entries are made for each unique sensor system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the tracking number, the first part of the composite key.

Field 2 (Attachment 1, Item D.1.a.) is the second part, i.e., the (unique) name of the sensor system, of the composite key.

Field 3 (Attachment 1, Item D.1.b.) is entered as the energy type(s) associated with the sensor system.

Field 4 (Attachment 1, Item D.1.c.) is entered as the type of sensor.

Field 5 (Attachment 1, Item D.1.d.) is entered as the environmental effect(s) required.

Field 6 (Attachment 1, Item D.1.e.) is entered as the line-of-sight sensor target geometry required.

Field 7 (Attachment 1, Item D.1.f.(1)) is entered as the required sensor altitude range.

Field 8 (Attachment 1, Item D.1.f.(2)) is entered as the target altitude range.

Field 9 (Attachment 1, Item D.1.g.(1)) is entered as the required quiescent environmental conditions.

Field 10 (Attachment 1, Item D.1.g.(2)) is entered as the required disturbed environmental conditions.

C.2.12. CAE_COMM.DB. Attachment 1, Item D.2. provides information on the Capabilities for Atmospheric Effects for COMMunications systems. The database table fields are the same as columns 1 and 2 of Item D.2. If more than one communications system is described, additional sets of entries are made for each unique communications system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the tracking number, of the composite key.

Field 2 (Attachment 1, Item D.2.a.) is the second part, i.e., the (unique) name of the communications system, of the composite key.

Field 3 (Attachment 1, Item D.2.b.) is entered as the energy type(s) associated with the communications system.

Field 4 (Attachment 1, Item D.2.c.) is entered as the environmental effect(s) required.

Field 5 (Attachment 1, Item D.2.d.) is entered as the transmitter-receiver geometry required.

Field 6 (Attachment 1, Item D.2.e.(1)) is entered as the required transmitter altitude range.

Field 7 (Attachment 1, Item D.2.e.(2)) is entered as the receiver altitude range).

Field 8 (Attachment 1, Item D.2.f.(1)) is entered as the required quiescent environmental conditions.

Field 9 (Attachment 1, Item D.2.f.(2)) is entered as the required disturbed environmental conditions.

C.2.13. CAE_WEAP.DB. Attachment 1, Item D.3. provides information on the Capabilities for Atmospheric Effects for WEAPon systems. The database table fields are the same as columns 1 and 2 of Item D.3. If more than one weapon system is described, additional sets of entries are made for each unique

weapon system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 1, Item D.3.a.) is the second part, i.e., the (unique) name of the weapons system, of the composite key.

Field 3 (Attachment 1, Item D.3.b.) describes the required atmospheric effects on the performance of the weapons system.

C.2.14. CAE_PLAT.DB. Attachment 1, Item D.4. provides information on the Capabilities for Atmospheric Effects for PLATforms. The database table fields are the same as columns 1 and 2 of Item D.4. If more than one platform is described, additional sets of entries are made for each unique platform. A description of each field for this database table follows. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 1, Item D.4.a.) is the second part, i.e., the name of the platform, of the composite key.

Field 3 (Attachment 1, Item D.4.b.) describes the required atmospheric effects on the performance of the platform.

C.2.15. CAE_FORC.DB. Attachment 1, Item D.5. provides information on the Capabilities for Atmospheric Effects for FORCes. If more than one force is described, additional sets of entries are made for each unique force. The database table fields are the same as columns 1 and 2 of Item D.5. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 1, Item D.5.a.) is the second part, i.e., the (unique) name of the force, of the composite key.

Field 3 (Attachment 1, Item D.5.b.) describes the required atmospheric effects on the performance of the force.

C.2.16. CAE_OTHR.DB. Attachment 1, Item D.6. provides information on the Capabilities for Atmospheric Effects for any OTHER type systems. The database table fields are the same as columns 1 and

2 of Item D.6. If more than one "other" type system is described, additional sets of entries are made for each unique system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 1, Item D.6.a.) is the second part, i.e., the (unique) name of the other system, of the composite key.

Field 3 (Attachment 1, Item D.6.b.) describes the required atmospheric effects on the performance of the other system.

C.2.17. CNSDE_SN.DB. Attachment 2, Item D.1. provides information on the Capabilities for Near Space Data and Effects for SeNsor systems. The database table fields are the same as columns 1 and 2 of Item D.1. If more than one sensor system is described, additional sets of entries are made for each sensor system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the tracking number, of the composite key.

Field 2 (Attachment 2, Item D.1.a.) is the second part, i.e., the (unique) name of the sensor system, of the composite key.

Field 3 (Attachment 2, Item D.1.b.) is entered as the energy type(s) associated with the sensor.

Field 4 (Attachment 2, Item D.1.c.) is entered as the type of sensor.

Field 5 (Attachment 2, Item D.1.d.) is entered as the environmental effect(s) required.

Field 6 (Attachment 2, Item D.1.e.) is entered as the line-of-sight sensor target geometry required.

Field 7 (Attachment 2, Item D.1.f.(1)) is entered as the required sensor altitude range.

Field 8 (Attachment 2, Item D.1.f.(2)) is entered as the target altitude range.

Field 9 (Attachment 2, Item D.1.g.(1)) is entered as the general state of the required quiescent environmental conditions.

Field 10 (Attachment 2, Item D.1.g.(2)) is entered as the general state of the required disturbed environmental conditions .

C.2.18. CNSDE_CM.DB. Attachment 2, Item D.2. provides information on the Capabilities for Near Space Data and Effects for CoMmunications systems. The database table fields are the same as columns 1 and 2 of Item D.2. If more than one communications system is described, additional sets of

entries are made for each communications system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the tracking number, of the composite key.

Field 2 (Attachment 2, Item D.2.a.) is the second part, i.e., the (unique) name of the communications system, of the composite key.

Field 3 (Attachment 2, Item D.2.b.) is entered as the energy type(s) associated with the communications system.

Field 4 (Attachment 2, Item D.2.c.) is entered as the environmental effect(s) required.

Field 5 (Attachment 2, Item D.2.d.) is entered as the transmitter-receiver geometry required.

Field 6 (Attachment 2, Item D.2.e.(1)) is entered as the required transmitter altitude range.

Field 7 (Attachment 2, Item D.2.e.(2)) is entered as the receiver altitude range.

Field 8 (Attachment 2, Item D.2.f.(1)) is entered as the general state of the required quiescent environmental conditions.

Field 9 (Attachment 2, Item D.2.f.(2)) is entered as the general state of the required disturbed environmental conditions.

C.2.19. CNSDE_WS.DB. Attachment 2, Item D.3. provides information on the Capabilities for Near Space Data and Effects for Weapons Systems. The database table fields are the same as columns 1 and 2 of Item D.3. If more than one weapon system is described, additional sets of entries are made for each weapon system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 2, Item D.3.a.) is the second part, i.e., the (unique) name of the weapons system, of the composite key.

Field 3 (Attachment 3, Item D.3.b.) describes they required near space effects on the performance of the weapons system.

C.2.20. CNSDE_PL.DB. Attachment 2, Item D.4. provides information on the Capabilities for Near Space Data and Effects for PLatforms. The database table fields are the same as columns 1 and 2 of Item D.3. If more than one platform is described, additional sets of entries are made for each platform. A

description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 2, Item D.4.a.) is the second part, i.e., the (unique) name of the platform, of the composite key.

Field 3 (Attachment 2, Item D.4.b.) describes the required near-space effect on the performance of the platform.

C.2.21. CNSDE_FO.DB. Attachment 2, Item D.5. provides information on the Capabilities for Near Space Data and Effects for FOrces. The database table fields are the same as columns 1 and 2 of Item D.5. If more than one force is described, additional sets of entries are made for each force. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 2, Item D.5.a.) is the second part, i.e., the (unique) name of the force, of the composite key.

Field 3 (Attachment 2, Item D.5.b.) describes the required near space effects on the performance of the force.

C.2.22. CNSDE_OT.DB. Attachment 2, Item D.6. provides information on the Capabilities for Near Space Data and Effects for OTher systems. The database table fields are the same as columns 1 and 2 of Item D.6. If more than one "other" type system is described, additional sets of entries are made for each "other" type system. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 is the first part, i.e., the unique tracking number, of the composite key.

Field 2 (Attachment 2, Item D.6.a.) is the second part, i.e., the (unique) name of the (other) object, of the composite key.

Field 3 (Attachment 2, Item D.6.b.) describes the required near space effects on the performance of the object.

C.2.23. SAMEFDLC.DB. Attachment 3, Items B.1. and B.2. provide information on the groupings of environmental data types identified in Attachment 1, Items C and D that have the SAME FiDeLity

Capabilities. A description of each field for this database table is given below. In parentheses after the field number is the relevant item from the Capabilities Questionnaire.

Field 1 (Attachment 3, Item A.) is the unique tracking number (*i.e.*, the same name entered in Field 2 of the ADMINCAP.DB database table), and the first part of the composite key.

Field 2 (Attachment 3, Item B.1.) is the second and final part of the composite key. Entries will be in the form of the letters "C" and "D" followed by numbers indicating groupings of atmospheric environmental data types from Attachment 1.

Field 3 (Attachment 3, Item B.2.) entries are the letters "C" and "D" followed by numbers indicating near-space-environment data types from Attachment 2.

APPENDIX D

DATABASE MANAGEMENT SYSTEM REPORTS

Report File Name	Report Description
ATMSINDX.RSL	Provides a cross reference between each type of atmospheric data and the models and databases providing that data.
CATALOG.RSL	Provides a summarization, sorted by military service owner and tracking number, of the models and databases as shown in Appendix F, which includes a description, point of contact, atmospheric and near space data type capabilities, and associated fidelity capabilities.
FIDLMODL.RSL	Provides a listing, sorted by military service owner and tracking number, of the atmospheric data fidelity capabilities of each model and database.
LISTCAPB.RSL	Provides a list of surveyed models and databases with their description, environmental issues identified as critical, and point of contact.
POT_CABP.RSL	Provides a list of potential future atmospheric data type capabilities of each surveyed model and database.
SPACEFDL.RSL	Provides a listing, sorted by military service owner and tracking number, of the near space data fidelity capabilities of each model and database.
SPACINDX.RSL	Provides a cross reference between each type of near space data and the models and databases providing that data.

APPENDIX E

LIST OF

ENVIRONMENTAL MODELS AND DATABASES

Service or Agency	Title of Environmental Model or Database [1]
Air Force:	**1. 3DNEPH 6-Monthly**
	2. 3DNEPH-LMHT/A Hemispheric
	3. 5-Layer Cloud Model
	4. A Climatological Model for 1-Minute Precipitation Rates
	5. AFGL-TR-89-0012, Effects of Rain Attenuation on Satellite EHF Communications in the United States
	6. AGRMET
	7. Air Combat Targeting/Electro-Optical Simulation (ACT/EOS)
	8. Atlas of Cloud-Free Line-of-Sight Probabilities, Parts 1–5: Northern Hemisphere
	9. Atmospheric Radiance Code/Auroral Atmospheric Radiance Code (ARC/AARC)
	10. Atmospheric Slant Path Analysis Model (ASPAM)
	11. Boundary Layer Window Analysis
	12. Celestial Background Scene Descriptor (CBSD)
	13. Clear and Cloud-Free Lines-of-Sight from Aircraft (Addendum)
	14. Cloud Scene Simulation Model (CSSM)
	15. Combined Radiation and Release Effects Satellite Proton Flux (CRRESPRO) Model
	16. Combined Radiation and Release Effects Satellite Space Radiation (CRRESRAD) Model
	17. DATSAV2 Aircraft
	18. DATSAV2 Rocketsonde
	19. DATSAV2 Satellite
	20. DATSAV2 Surface
	21. DATSAV2 Upper Air
	22. Drop-Size Distribution Associated with Intense Rainfall
	23. Eighth-Mesh Surface Temperature Analysis
	24. Electro-Optical Tactical Decision Aid (EOTDA)
	25. Estimating Probabilities of Cloud-Free Fields-of-View from Earth Through the Atmosphere
	26. FASCOD3 (to be FASCODE4 or FASE)
	27. High Resolution Analysis
	28. High Resolution Analysis System/Global Spectral Model (HIRAS/GSM)
	29. High Resolution Cloud Prognosis (HRCP)
	30. Improved Aurora Precipitation Model (IAPM)
	31. Interplanetary Shock Propagation Model
	32. Jacchia Atmospheric Density (JAD) Model, 1970
	33. Lightning
	34. MM5
	35. MODTRAN3 (replacing LOWTRAN7)
	36. Magnetosphere Specification and Forecast Model

[1] Models and databases in **boldface** indicate a Capabilities Questionnaire has been received for them, and the data from the questionnaires have been entered into the E^2DIS Project Capabilities Survey database.

Service or Agency	Title of Environmental Model or Database
Air Force: (continued)	**37. Military Standard 210C, Climatic Information to Determine Design and Test Requirements for Military Systems and Equipment (MIL-STD-210C)**
	38. Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
	39. New Tropical (TRONEW) Cloud Model
	40. Night Vision Goggle Operations (NOWS)
	41. Night Vision Goggle Operations (NOWS) Weather Software Database
	42. PIBAL
	43. PLEXUS
	44. Probability-of-Cloud Statistics (C Cloud S)
	45. RAMS
	46. RTNEPH 6-Month
	47. RTNEPH Histogram
	48. RTNEPH-LMHT/A Hemispheric
	49. Radiosonde
	50. Real-Time Nephanalysis (RTNEPH)
	51. Relocatable Window Model (RWM)
	52. SHARE and MODTRAN Merged (SAMM)
	53. Snow Depth (SNODEP)
	54. Snow Depth Climatology
	55. Solar Flare Forecast Model
	56. Solar Wind Transport Model
	57. Space Environmental Specification and Forecast System (SESFS)
	58. Strategic High Altitude Radiance Code (SHARC)
	59. Summary of the Day
	60. Surface Temperature Model (SFCTMP)
	61. Synthetic 3-D Atmospheric Temperature: A Model for Known Geophysical Power Spectra Using a Hybrid Autoregression and Fourier Technique
	62. Upper-Air Window Analysis
	63. Universal Methods for Estimating Probabilities of Cloud-Free Lines-of-Sight Through the Atmosphere
	64. Vertical Velocity Analysis
	65. Winds Aloft
Army:	**1. AGAUS–A Mie Code**
	2. BITS–Broadband Integrated Transmittances
	3. CLIMAT–The Climatology Model
	4. COMBIC–Combined Obscuration Model for Battlefield-Induced Contaminants
	5. COPTER–Obscuration Due to Helicopter Lofted Snow and Dust Module
	6. FASCAT–Atmospheric Illumination Module
	7. FITTE–The Fire-Induced Transmission and Turbulence Effects Module
	8. GRNADE–Self-Screening Applications Module
	9. ILUMA–Natural Illumination Under Realistic Weather Conditions
	10. KWIK–A Munition Expenditures Module
	11. LASS–Large Area Screening Systems Application Module
	12. LOWTRN–Atmospheric Transmittance/Radiance Module
	13. LZTRAN–Laser Transmittance Module
	14. MPLUME–Missile Smoke Plume Obscuration Code

Service or Agency	Title of Environmental Model or Database
Army: (continued)	**15. NAPS–Noise Assessment and Prediction System**
	16. NBSCAT–Narrow Beam Multiple Scattering Module
	17. NMMW–Near Millimeter Wave Module
	18. NOVAE–Nonlinear Aerosol Vaporization and Breakdown Effects Module.
	19. OVRCST–Contrast Transmission Module
	20. PEGASUS
	21. PFNDAT–Aerosol Phase Function Data Base
	22. RADAR–Millimeter Wave System Performance Module
	23. REFRAC–Optical Path Bending Code Module
	24. SCAPE–Scanning Parabolic Equation
	25. SCAPPIF–Scanning Fast Field Program Module
	26. Smart Weapons Operability Enhancement (SWOE)
	27. Spherical–Ground impedance model based on equations by Attenborough
	28. Synthetic Environments
	29. TARGAC–Target Acquisition Model
	30. UVTRAN–An Ultraviolet Transmission and Lidar Simulation Module
	31. XSCALE–Natural Extinction Module
Navy:	**1. Aircraft Icing (AIRICE)**
	2. Anti-Air Warfare Aircraft Stationing Aid (AAW)
	3. Battle Group Vulnerability (BGV)
	4. Chaff Corridor Density (CCD) Model
	5. Chaff Dispersion and Density (CHADIS) Model
	6. Chaff Trajectory Function (CHATRA) Model
	7. Chemical/Biological Agent Vapor, Liquid, and Solid (VLSTRACK) Model
	8. Composite Area Analysis Model (CAAM)
	9. Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
	10. Create Atmospheric Refractive Data Set (CARDS)
	11. D-Values
	12. Direct Method Evaporation Duct (DMED) Model
	13. Electromagnetic (EM) Coverage Diagram (COVER)
	14. Electromagnetic (EM) Path Loss vs. Range (LOSS)
	15. Electromagnetic Propagation Conditions Summary (PCS)
	16. Electronic Countermeasures (ECM) Effectiveness Display
	17. Electronic Support Measures (ESM) Range Tables
	18. Evaporation Duct Height (EDH) Model
	19. Forward-Looking Infrared (FLIR) System Prediction
	20. HF Lowest Usable Frequency (HF LUF)
	21. HF Maximum Usable Frequency (HF MUF) Program
	22. High Frequency Communications (HF COMMS)
	23. High Frequency Environmental Acoustics Model (HFEAM)
	24. Historical Electromagnetic Propagation Conditions (HEPC)
	25. Historical Wind Speed (HWS)
	26. Laser Range Prediction (LRP)
	27. Meteorological Ballistic Winds and Densities Model (BALWIN)
	28. Multivariate Optimum Interpolation (MVOI)
	29. Navy Operational Global Atmospheric Prediction System (NOGAPS)

Service or Agency	Title of Environmental Model or Database
Navy: (continued)	**30. Navy Operational Regional Atmospheric Prediction System (NORAPS)**
	31. Ooyama Analysis
	32. Orbit Determination Program (ODP)
	33. Pilot Balloon (PIBAL)
	34. Platform Vulnerability
	35. Pressure Altitude/Density Altitude (PADA)
	36. Radar Free-Space Detection Range (RFSDR)
	37. Radio Physical Optics (RPO)
	38. Radiological Fallout (RADFO)
	39. Radiosonde Initial Analysis (RIA)
	40. Rowland-Rotter Evaporation Duct Model (RRM)
	41. Sea-Surface Temperature Analysis and Composite (SSTAC)
	42. Seakeeping Evaluation Program (SEP) Wind and Wave Database
	43. Seasonal Cloud Amount and Cloud-Free Line-Of-Sight Data for Oceans
	44. Ship Ice Accretion (SHIP ICE)
	45. Solar/Lunar Almanac Program (SLAP)
	46. Sound Focus (SOCUS)
	47. Standard Electromagnetic Propagation (Standard EM Prop)
	48. Rowland-Rotter Evaporation Duct Model (RRM)
	49. Submarine Technological Environmental (STE) Database–Clouds
	50. Surface-Search Radar (SRR) Range Table
	51. Tactical Environmental Knowledge Base System (TEKBS)
	52. Tactical/Environmental Ship Routing (TESR)
	53. Temperature Utility (TEMP UTL)
	54. The OAML Navy Standard Radar Sea Clutter (CLUTTER) Model
	55. Tomahawk Anti-Ship Missile (TASM) Effective Wind Model
	56. Tomahawk Environmental Calculation Aid (TECA)
	57. Tomahawk Land Attack Missile (TLAM) Wind and Temperature Correction
	58. Tropical Cyclone Module
	59. Tropospheric Electromagnetic Parabolic Equation Routine (TEMPER)
	60. Warnings Plot
	61. Wind Conversion Utility (TRUE WIND)

APPENDIX F

ENVIRONMENTAL MODELS AND DATABASES

IN THE

CAPABILITIES SURVEY DATABASE

Air Force

E[2]DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	501
Model or DB Title	Electro-Optical Tactical Decision Aid (EOTDA)
Description	Using weather, target, and background information, the EOTDA calculates detection and lock-on range for air-to-ground precision-guided munitions and detection systems operating in the infrared, television, and laser wavelengths.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Lt Col Joseph Alleca
Address–Line 1	PL/GPAA
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2963
E-mail Address	alleca@plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	N/A	N/A	15 min
Transmissivity	N/A	N/A	15 min

Air Force

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	502
Model or DB Title	Night Vision Goggle Operations (NOWS)
Description	NOWS uses weather, target, and background information to calculate night vision goggle detection range for air-to-air and air-to-ground scenarios.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Lt Col Joseph Alleca
Address–Line 1	PL/GPAA
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2963
E-mail Address	alleca@plh.af.mil

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	503
Model or DB Title	Air Combat Targeting/Electro-Optical Simulation (ACT/EOS)
Description	ACT/EOS will permit pilots to visualize IR scenes (as seen by the IR weapon/ navigator) prior to flight as part of the Air Force Mission Planning System.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Lt Col Joseph Alleca
Address–Line 1	PL/GPAA
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2963
E-mail Address	alleca@plh.af.mil

Air Force

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	504
Model or DB Title	Night Vision Goggle Operations (NOWS) Weather Software Database
Description	The database will be used to validate NOWS.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Lt Col Joseph Alleca
Address–Line 1	PL/GPAA
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2963
E-mail Address	alleca@plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	N/A		
Clouds	N/A		
Dew Point Temperature	N/A		
Fog	N/A		
Humidity	N/A		
Mixing Ratio	N/A		
Precipitation	N/A		
Radiative Features	N/A		
Temperature	N/A		
Visibility	N/A		
Winds	N/A		

Tracking No.	505
Model or DB Title	FASCOD3 (to be FASCODE4 or FASE)
Description	One-by-one "exact" atmospheric radiation/transmittance code at required high spectral resolution for arbitrary slant paths and meteorological conditions to capture detailed Voigt line shape, including non-LTE (nonlocal thermal equilibrium) effects. Accounts for "exact" molecular spectroscopy as it affects radiation propagating through the atmosphere, including absorption, scattering, and emission by/from profiles with a spectral range from UV to microwave and an altitude range from 0 to 120 km. Both laboratory and atmospheric simulations are possible with the user either choosing or accepting defaults of species, clouds, aerosols, etc. FASCOD3 is primarily a remote sensing tool that simulates any high resolution spectral data in the above range (note that solar is excluded).
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Ms. Gail Anderson
Address–Line 1	PL/GPOS
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2335
E-mail Address	ganderson@plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	shell	10 s m	
Clouds	shell	10 s m	
Combat-generated Dust			
Contrail Formation/Dispersion		100 s m	
Dew Point Temperature	shell	10 s m	
Fog	shell	10 s m	
Humidity	shell	10 s m	

Tracking No. 505 (Continued)

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Mixing Ratio			
Precipitation	shell	100 s m	
Radiative Features			
Refractivity	shell	meters	
Sea Level Pressure	shell		
Smoke	100 s m		
Static Pressure			
Temperature	shell		
Trace Gases	shell	10 s m	
Transmissivity	10 s m		
Visibility			
Winds			

Tracking No.	506
Model or DB Title	MODTRAN3 (replacing LOWTRAN7)
Description	MODTRAN3 is a moderate resolution (spectral range 5–50,000 cm^{-1}) atmospheric propagation model and computer code for predicting transmittance and background radiance. The Atmospheric Radiation/Transmittance Algorithm is at 2 cm^{-1} minimum resolution, covers the spectral range from near UV to the mm region, and includes the effects of molecular and aerosol attenuation. The line-of-sight covers all realistic configurations with spherical geometry and default choices. It is a two-parameter band model with 3% accuracy relative to line-by-line codes. MODTRAN3 provides Voight line shape, has no non-LTE (nonlocal thermodynamic equilibrium) capabil-ity, but does have a solar/lunar capability.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Ms. Gail Anderson
Address–Line 1	PL/GPOS
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2335
E-mail Address	ganderson@plh.af.mil

Air Force

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	507
Model or DB Title	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
Description	MOSART is a unified, seamless, and scientifically consistent computer code for calculating atmospheric transmission and radiance at low altitudes for line-of-sight paths within the atmosphere and for paths that intersect the earth's surface. MOSART used a band model approach to radiation transport to model low-altitude optical backgrounds and transmission in the ultraviolet region through the micro-wave spectral region, approximately 0.2 to 50 µm, at a spectral resolution of 2.0 cm^{-1}.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Laila Jeong
Address–Line 1	PL/GPOS
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-3671
E-mail Address	jeong@plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	N/A	10 s m	N/A
Clouds	N/A	10 s m	N/A
Dew Point Temperature	N/A	10 s m	N/A
Fog	N/A	10 s m	N/A
Humidity	N/A	10 s m	N/A
Mixing Ratio	N/A	10 s m	N/A
Precipitation	N/A	10 s m	N/A
Radiative Features	N/A	10 s m	N/A
Refractivity	N/A	N/A	N/A
Sea Level Pressure	N/A	N/A	
Temperature	4.5° latitude	10 s m	N/A
Trace Gases	N/A	10 s m	N/A
Transmissivity	N/A	10 s m	N/A

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	508
Model or DB Title	Strategic High Altitude Radiance Code (SHARC)
Description	SHARC calculates radiance in the 2–40 μm spectral range at altitudes between 50 and 300 km from active infrared radiators (for example, CO_2, NO, OH, CH_4, H_2O, NO+, and O_3), taking into account the nonequilibrium nature of the sources.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Ramesh Sharma
Address–Line 1	PL/GPOS
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-4198
E-mail Address	ramesh@pldec.plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features		none	variable

Air Force

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	509
Model or DB Title	SHARE and MODTRAN Merged (SAMM)
Description	SAMM calculates the atmospheric radiance and transmission over the 1- to 40-µm spectral range, arbitrary LOS, from the surface to 300 km.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Ramesh Sharma
Address-Line1	PL/GPOS
Address-Line2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-4198
E-mail Address	ramesh@pldec.plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	none	variable	N/A

Tracking No.	510
Model or DB Title	Synthetic 3-D Atmospheric Temperature: A Model for Known Geophysical Power Spectra Using a Hybrid Autoregression and Fourier Technique
Description	Geophysical phenomena are often characterized by smooth continuous power spectra having a domain of negative-slope, power-law dependence. Frequently, Fourier transform analysis has been employed to synthesize scenes from pseudo-random arrays by passing the random samples through a Fourier filter having a desired correlation structure and power density. This model approaches synthesis of three-dimensional synthetic structure by invoking autoregression analysis in conjunction with Fourier methods.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. James Brown
Address–Line 1	PL/GPOS
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-4412

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature	0.1 x 16 km	100 m	N/A

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	511
Model or DB Title	Cloud Scene Simulation Model (CSSM)
Description	CSSM is a prototype, empirical cloud model developed to support high-fidelity training and simulation applications. TASC has developed CSSM to simulate realistic high-resolution cloud features within domains defined by larger scale weather conditions. Cumulus is the only cloud type currently modeled, but other types, such as cirrus and stratus, will be modeled in the future.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Joel Mozer
Address–Line 1	PL/GPAA
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2945
E-mail Address	mozer@plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	1–100 m	1–100 m	1–10 min
Clouds	1–100 m	1–100 m	
Precipitation	1–100 m	1–100 m	

Tracking No.	512
Model or DB Title	Atmospheric Radiance Code/Auroral Atmospheric Radiance Code (ARC/AARC)
Description	ARC/AARC is a set of first-principles short-wave infrared/medium-wave infrared/long-wave infrared (SWIR/MWIR/LWIR) radiance codes designed to model scientific research data and to test performance of other more approximate codes. It calculates nonlocal thermodynamic equilibrium (non-LTE) atmospheric spectral radiance, including airglow, from the undisturbed atmosphere in the altitude range of 30–200 km. At the core of ARC/AARC is a unique algorithm of highly accurate line-by-line (LBL) solution of the non-LTE radiative transfer problem, in both its radiative-excitation and its line-of-sight radiance aspects.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Richard Picard
Address–Line 1	PL/GPOS
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2222
E-mail Address	jpicard@plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Nuclear Weapons Effects	~1000 m		
Transmissivity	N/A	1000 m	N/A

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Auroral Particle	arbitrary	1000 m	N/A

Air Force

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	513
Model or DB Title	PLEXUS
Description	PLEXUS is a suite of atmospheric radiance and transmission codes with a common graphical user interface and an expert system for user assistance.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Frank Clark
Address–Line 1	PL/GPOB
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-4139
E-mail Address	fclark@plh.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features			
Refractivity			
Trace Gases			
Transmissivity			

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Auroral Particle			
Diffuse Zodiacal Emission			
Geomagnetic Field			
Lunar Parameters	2 s arc	2 s arc	N/A
Meteoroids and Debris			
Radio Background Noise			
Solar Parameters	2 s arc	2 s arc	N/A
Star and Planetary Positions	2 s arc	2 s arc	N/A

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	514
Model or DB Title	Combined Radiation and Release Effects Satellite Proton Flux (CRRESPRO) Model
Description	CRRESPRO calculates proton and omni-directional fluence and interval omni-directional fluence over the energy range 1–100 MeV for user-specified orbits and quiet, active, or average geophysical conditions.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. M. Gussenhoven
Address–Line 1	PL/GPSP
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-3212
E-mail Address	gussen@plh.af.mil

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Energetic Parameters	2° mag lat	1/20 earth radii	activity level
Geomagnetic Storms			activity level

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	515
Model or DB Title	Combined Radiation and Release Effects Satellite Space Radiation (CRRESRAD) Model
Description	CRRESRAD calculates expected satellite dose accumulation behind four different thicknesses of aluminum shielding for user-specified orbits and quiet or active levels of geophysical activity.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. M. Gussenhoven
Address–Line 1	PL/GPSP
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-3212
E-mail Address	gussen@plh.af.mil

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Energetic Parameters	2° mag lat	1/20 earth radii	activity level
Geomagnetic Storms			activity level

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	516
Model or DB Title	Improved Aurora Precipitation Model (IAPM)
Description	The IAPM specifies the location and intensity of auroral precipitation relative to the location of a ground-based C3I system.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. David Hardy
Address–Line 1	PL/GPSG
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-3103

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Auroral Particle	2 x 7.5° mag coor		hr

Air Force

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	517
Model or DB Title	Interplanetary Shock Propagation Model (ISPM)
Description	The ISPM determines the propagation from the sun to the earth of disturbances originating in solar flares and coronal mass ejections. It provides the largest possible leadtime (up to about 4 days) in forecasting conditions of the near-earth space environment resulting from solar activity.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Michael Heinemann
Address–Line 1	PL/GPSG
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2434
E-mail Address	heinemann@plh.af.mil

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Geomagnetic Storms			
Interplanetary Medium	2 solar radii	2 solar radii	10 s

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	518
Model or DB Title	Magnetosphere Specification and Forecast Model (MSFM)
Description	The MSFM is designed to specify and predict the 0–100 KeV particle and magnetic field environment of the earth's inner and middle magnetosphere. The modeled region is three-dimensional and extends beyond the geostationary orbit.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Michael Heinemann
Address–Line 1	PL/GPSG
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2434
E-mail Address	heinemann@plh.af.mil

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Geomagnetic Field	7.5°	~3000 km	15 min
Geomagnetic Storms	~7.5°	~3000 km	
Low Energy Plasma	7.5°	~3000 km	15 min

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	519
Model or DB Title	Solar Wind Transport Model (SWTM)
Description	The SWTM is designed to model and predict the flow of solar wind from a solar wind sensor located near the Lagrange point to the earth, and simultaneously to model the formation of the shock wave and the magnetopause as the plasma flows past the earth.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Michael Heinemann
Address–Line 1	PL/GPSG
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2434
E-mail Address	heinemann@plh.af.mil

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Geomagnetic Storms			
Interplanetary Medium	~2 earth radii	112,000 km	10 s

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	520
Model or DB Title	Solar Flare Forecast Model (SFFM)
Description	The SFFM is based on multivariate discriminant analysis; the SFFM's objective is to generate a probability for a flare of given magnitude to occur in a specified window of time. The forecast window is 24 hr, and the application domain is one solar active region. Output is the "class" (decades of energy level) of the largest flare occurring within a solar active region, ranging over several orders of magnitude, with the lowest class being no flare.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Donald Neidig
Address–Line 1	PL/GPSS
Address–Line 2	Sacramento Peak Observatory
Location	Sunspot, NM 88349
Phone Number	505 434-7542
E-mail Address	neidig@sunspot.noaa.edu

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Geomagnetic Storms			
Solar Parameters	solar active region		

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	521
Model or DB Title	AGRMET
Description	AGRMET is a near real-time analysis model of surface meteorological conditions and soil conditions at two subsurface levels with ~ 25 nmi horizontal resolution. The AGRMET model output data are delivered to the USDA/Foreign Agriculture Service for its use as input to crop-yield assessment and prediction models.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
E-mail Address	KWALDRON@oafbmail.offutt.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity	47,625 m	N/A	24 hr
Precipitation	47,625 m	N/A	24 hr
Radiative Features	47,625 m	N/A	24 hr
Temperature	47,625 m	N/A	24 hr
Winds	47,625 m	N/A	24 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	522
Model or DB Title	Atmospheric Slant Path Analysis Model (ASPAM)
Description	ASPAM produces (1) post-analysis profiles of the atmosphere from the surface to 400,000 ft, (2) 1-sigma error estimates of temperature and absolute humidity, and (3) 24-hr surface weather history of a user-selected analysis point, and (4) stratospheric aerosol information.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
E-mail Address	KWALDRON@oafbmail.offutt.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	46 km	3 layers	N/A
Clouds	46 km	3 layers	N/A
Humidity	N/A	variable	N/A
Refractivity	N/A	variable	N/A
Sea Level Pressure	N/A	N/A	N/A
Temperature	N/A	variable	N/A
Visibility	N/A	N/A	N/A
Winds	N/A	variable	N/A

Air Force

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	523
Model or DB Title	Five-Layer Cloud Model (FLCM)
Description	The FLCM produces medium-resolution hemispheric, excluding the tropics, forecasts of cloud cover and layer clouds.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	190 km	standard pressure levels	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	524
Model or DB Title	High Resolution Cloud Prognosis (HRCP)
Description	The HRCP generates a short-range, high-resolution forecast of total and layered cloud. It uses a three-dimensional advection scheme, which works well for synoptic systems for the first 9 hr but does not handle cumulus forecasts or stratus formation and dissipation. In addition to RTNEPH cloud data, the HRCP has input of wind trajectory, condensation pressure spread, and dew point information. Forecasts are made in 3-hr time steps to a maximum of 9 hr.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
E-mail Address	KWALDRON@oafbmail.offutt.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	46 km	standard pressure levels	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	525
Model or DB Title	High Resolution Analysis System/Global Spectral Model (HIRAS/GSM)
Description	The HIRAS and GSM together (1) generate flight-level wind information for computer flight plans, (2) provide analysis and forecast data for the generation of mission-tailored products for use in the field and for regional/theater scale weather analysis and forecast models, and (3) provide uniform gridded data fields (UGDF) to weather units.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
E-mail Address	KWALDRON@oafbmail.offutt.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity	278 km	1810 m	3 hr
Sea Level Pressure	278 km	N/A	3 hr
Temperature	278 km	1864 m	3 hr
Winds	278 km	1864 m	3 hr

Tracking No.	526
Model or DB Title	Real-Time Nephanalysis (RTNEPH)
Description	The RTNEPH replaced the 3-dimensional nephanalysis (3DNEPH) as the Air Force Global Weather Central (AFGWC) cloud analysis model in August 1983. Similar to 3DNEPH, the RTNEPH blends high resolution satellite data and conventional data to perform an automated cloud analysis. The vertical structure of the RTNEPH is different, however, having four floating vertical layers that allow greater vertical resolution because the cloud bases and tops are sharply defined. The primary use of the RTNEPH database is to initialize the AFGWC cloud forecast models. Input to the RTNEPH cloud analysis model is primarily single-channel infrared data but also visual data, conventional weather observations, snow data, surface temperatures, and upper-air analyses. The RTNEPH employs a "threshold" method to analyze satellite data. Using the surface temperature database, background brightness, and other empirical corrections, the RTNEPH determines a pixel value for the "cloud/ no-cloud" threshold. Any pixels having a value colder (brighter) than the threshold are recorded as indicating a cloud is present. A "clustering" technique determines cloud layers and amounts on an eighth-mesh (25 nmi), polar stereographic grid with up to four floating cloud layers at each grid point.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
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Phone Number	402 294-4671
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	46 km	floating	_ 3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	527
Model or DB Title	Relocatable Window Model (RWM)
Description	The RWM is AFGWC's regional and theater-scale forecast model, limited to three fixed windows (Europe, Asia, and CONUS) and up to four contingency windows. The grid spacing for the fixed windows is 50 nmi and is user-specified for the contingency windows. The forecasts are output as frequently as every 3 hr out to 36 hr. In 1994 the RWM was linked with real-time inputs of snow-ice cover, soil temperature, and soil moisture from other AFGWC-unique models to improve the low level initialization, essential to forecasting accurately initiation of convection and precipitation type. The RWM is run operationally with grid spacing as fine as 25 nmi, small enough to capture many orographic features—in particular the low-level wind fields, which are strongly dependent on accurate depiction of the terrain. The RWM quality is dependent on data availability and accuracy, as well as model limitations. The RWM uses the Global Spectral Model for a first guess field, and then the Relocatable Window Analysis Model searches the database for all observations (including RAOBs, surface observations, and satellite soundings) in or near the window domain to produce a tailored analysis on the model grid. Quality can be seriously impacted in data poor regions.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
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Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity	93 km	variable	3 hr
Precipitation	93 km	N/A	3 hr
Temperature	93 km	variable	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	528
Model/DB Title	Snow Depth (SNODEP)
Description	The input to the SNODEP model includes conventional and satellite observations; land, sea, and ice geography; continuity; and snow climatology. SNODEP produces high-resolution global analyses of snow depths and ice cover on an eighth-mesh (25 nmi) grid. The output is reviewed by forecasters and modified, or "bogused," if obvious errors are found in the analysis.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
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Phone Number	402 294-4671
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Air Force

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	529
Model or DB Title	Surface Temperature Model (SFCTMP)
Description	The SFCTMP is designed to analyze and forecast (short-range) worldwide surface temperatures at eighth-mesh (25 nmi) grid points and 3-hourly intervals. Temperatures are modeled at the earth's surface (skin) and shelter height (2 m). Over water, the Navy's sea surface temperature data are interpolated to the SFCTMP grid; the surface and shelter temperatures are assumed to be identical.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature	93 km	1 m (sfc)	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	530
Model or DB Title	New Tropical (TRONEW) Cloud Model
Description	TRONEW produces medium-resolution tropical forecasts of cloud cover and low, middle, and high layer amounts.
Organization	Air Force Global Weather Central (AFGWC/SYSM)
Point of Contact	Capt Kim Waldron
Address–Line 1	MBB 39
Address–Line 2	106 Peacekeeper Drive, Ste 2N3
Location	Offutt AFB, NE 68113-4039
Phone Number	402 294-4671
E-mail Address	KWALDRON@oafbmail.offutt.af.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	190 km	low/middle/high	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	531
Model or DB Title	DATSAV2 Surface
Description	The DATSAV2 Surface Model contains worldwide surface observations (synoptic, airways, METAR, synoptic ship) for about 13,000 stations. All weather elements transmitted are retained; in some cases, computed and derived values are incorporated into the record. Also available are "station files"—individual station data sets for selected stations—that have received more quality control. The elements include wind direction, snowfall and snow depth data, wind speed, runway data, barometric pressures, hail data, pressure tendency and change, sunshine data, dry bulb temperature, ground temperature and conditions, dewpoint temperature, maximum and minimum temperatures, total sky cover, ship data, visibility, sea surface temperature, past and present weather, wave data, cloud layer data, swell data, ceiling, ship ice reports, and precipitation data.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	NA	NA	Hourly
Atmospheric Electricity	NA	NA	Hourly
Clouds	NA	NA	Hourly
Dew Point Temperature	NA	NA	Hourly
Fog	NA	NA	Hourly
Precipitation	NA	NA	Hourly
Radiative Features	NA	NA	Hourly

Air Force

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No. 531 (Continued)

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Smoke	NA	NA	Hourly
Temperature	NA	NA	Hourly
Visibility	NA	NA	Hourly
Winds	NA	NA	Hourly
Winds–Specific Features	NA	NA	Hourly

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	532
Model or DB Title	Summary of the Day—Tape Data Format (TDF)-34
Description	The TDF-34 consists of daily element summaries for 1,795 stations (primarily U.S.-operated) as digitized from original records. Periods of record vary significantly from station to station. Elements included are maximum temperature, minimum temperature, peak wind, precipitation, mean temperature, snowfall, snow depth, and number of days with thunderstorms, snow, sleet, blowing snow, hail rain, dust or sand, fog, smoke or haze.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704-271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	NA	NA	Hourly
Fog	NA	NA	Hourly
Precipitation	NA	NA	Hourly
Smoke	NA	NA	Hourly
Temperature	NA	NA	Hourly
Winds	NA	NA	Hourly
Winds–Specific Features	NA	NA	Hourly

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	533
Model or DB Title	DATSAV2 Satellite
Description	Each GOES wind record contains wind direction and speed information at a single pressure level.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds	NA	NA	Daily

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	534
Model or DB Title	DATSAV2 Rocketsonde
Description	The DATSAV2 Rocketsonde consists of rocketsonde observations of height, temperature, pressure, wind direction and speed, and density from an altitude of 20 km to above 90 km.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature	NA	NA	Sporadic
Winds	NA	NA	Sporadic

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	535
Model or DB Title	DATSAV2 Upper Air
Description	The DATSAV2 Upper Air includes radiosonde, rawinsonde, PIBAL (pilot balloon), and dropsonde observations, with data reaching from the surface to, in some cases, higher than 10 MB. The observations consist of pressure, stability indices, height, temperature, dewpoint temperature, thermal wind direction, thermal wind speed, wind direction, wind speed, maximum winds, mean winds, precipitable water, saturation moisture ration, cloud data, tropopause data, present weather, and freezing levels.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	NA	NA	Hourly
Dew Point Temperature	NA	NA	Hourly
Static Pressure	NA	NA	Hourly
Temperature	NA	NA	Hourly
Winds	NA	NA	Hourly

Tracking No.	536
Model or DB Title	DATSAV2 Aircraft
Description	The DATSAV2 consists of aircraft reports collected worldwide, with the greatest concentration over the U.S. and along major air routes. Types of reports included are RECCO (reconnaissance observation), COMBAR (combat aircraft report), MAC Abbreviated (Military Airlift Command aircraft report), CODAR (nonreconnaissance aircraft upper-air report), ASDAR (aircraft-satellite data acquisition radar report) AIREPS (aircraft reports), domestic PIREPS (pilot reports), and ICAO (International Civil Aviation Organization report). The archived observations are wind direction, wind speed, D-value, temperature, dew point depression, altitude of mandatory pressure level, frequency of turbulence, intensity of turbulence, type of turbulence cloud and contrail data, icing data, in-flight and off-course weather, flight visibility, and radar data.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Atmospheric Electricity	NA	NA	Sporadic
Clouds	NA	NA	Sporadic
Contrail Formation and Dispersion	NA	NA	Sporadic
Dew Point Temperature	NA	NA	Sporadic
Precipitation	NA	NA	Sporadic
Temperature	NA	NA	Sporadic

Tracking No. 536 (Continued)

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Visibility	NA	NA	Sporadic
Winds	NA	NA	Sporadic
Winds—Specific Features	NA	NA	Sporadic

Air Force

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	537
Model or DB Title	PIBAL
Description	The TDF-52 consists of foreign PIBAL (pilot balloon) winds (wind speed and wind direction) aloft data for 1,217 stations. The data were digitized from original records and include wind at a varying number of fixed height and/or pressure levels. Periods of record vary significantly from station to station.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds	NA	NA	Sporadic

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	538
Model or DB Title	Winds Aloft
Description	The TDF-53 contains worldwide winds aloft data for 1,660 stations gathered from PIBAL (pilot balloon), radiosonde, and rawinsonde reports as digitized from original records and other source material. It Includes wind speed and wind direction data for a varying number of fixed height levels. Periods of record vary significantly from station to station.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds	NA	NA	Sporadic

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	539
Model or DB Title	Radiosonde
Description	The TDF-54 consists of worldwide radiosonde data (height, relative humidity, temperature, wind direction, pressure, and wind speed) for 1,170 stations as digitized from original records. The data include varying numbers of fixed height and/or pressure levels, including some mandatory levels with periods of records varying significantly from station to station.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity	NA	NA	Sporadic
Temperature	NA	NA	Sporadic
Winds	NA	NA	Sporadic

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	540
Model or DB Title	Lightning
Description	The lightning database contains lightning stroke information (number of strokes, polarity, peak current signal strength, and relative amplitude) for the continental United States collected through various networks and primarily compiled by GEOMET Data Services. This database is not available for non-DOD customers through the National Climatic Data Center.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Atmospheric Electricity	NA	NA	Sporadic

Air Force

E[2]DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	541
Model or DB Title	RTNEPH 6-Month
Description	The RTNEPH 6-Month database consists of cloud and weather information, stored at 6-month intervals, compiled from both conventional surface and upper-air reports and satellite data. Observed clouds are placed within one of four floating layers, with the first layer defined as the highest. The analysis data is on a 512 x 512 subset of the eighth mesh grid and includes data for both hemispheres, eight times a day on each synoptic hour. Each hemisphere is divided into 60 boxes (64x64 grid points in each) on the eighth-mesh grid. The data at a particular grid point may include either zero, one, two, three, or four layers of cloud information, depending on observed conditions. The data consist of cloud type for each of the four layers, percent coverage for each of the four layers, minimum cloud base for each of the four layers, maximum cloud top for each of the four layers, total cloud coverage, present weather report, visibility report, and data age and source information.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	25 NM	4 layers	3 hr
Clouds	25 NM	4 layers	3 hr
Fog	25 NM	4 layers	3 hr
Precipitation	25 NM	4 layers	3 hr
Visibility	25 NM	4 layers	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	542
Model or DB Title	RTNEPH Histogram
Description	The RTNEPH histogram contains low, middle, and high cloud types and amounts (LMHT/A), plus total cloud coverage derived from the RTNEPH database. Analyses are on a 512 x 512 subset of the eighth-mesh grid and include data for both hemispheres eight times a day on each synoptic hour. The LMHT/A histogram file consists of a frequency distribution of the number of days by month and hour each element falls within specified limits. The elements are total cloud amount, low cloud type and amount, middle cloud type and amount, and high cloud type and amount.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	25 nmi	4 layers	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	543
Model or DB Title	RTNEPH-LMHT/A Hemispheric
Description	The LMHT/A database contains low, middle, and high cloud types and amounts, plus total cloud coverage derived from the RTNEPH database. Analyses are on a 512 x 512 subset of the eighth-mesh grid and include data for both hemispheres eight times a day on each synoptic hour. Data elements include total cloud amount, low cloud type and amount, middle cloud type and amount, and high cloud type and amount.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	25 nmi	4 layers	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	544
Model/DB Title	3DNEPH 6-Monthly
Description	The 3DNEPH 6-Monthly database consists of cloud information, stored at 6-month intervals, compiled from conventional surface and upper-air reports and satellite data. Observed clouds are placed in 1 of 15 fixed thickness layers. The first 6 layers are between the surface and 3,500 ft above ground level; the remaining nine levels are between 3,500 and 40,000 ft above sea level. Analyses are on a 512 x 512 subset of the eighth mesh grid. They include data for both hemispheres, eight times a day on each synoptic hour (but only 03, 09, 15, and 21 Z for Southern Hemisphere data from January 1977 through July 1978). Each hemisphere is divided into 60 boxes (64x64 grid points in each) on the eighth-mesh grid. The database contains percent cloud coverage for each of the 15 layers, low cloud type, middle cloud type, high cloud type, total cloud coverage, minimum cloud base, maximum cloud top, and the present weather report.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	25 nmi	15 layers	3 hr
Clouds	25 nmi	15 layers	3 hr
Fog	25 nmi	15 layers	3 hr
Precipitation	25 nmi	15 layers	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	545
Model or DB Title	3DNEPH-LMHT/A Hemispheric
Description	The LMHT/A Hemispheric database is derived from the 15 fixed-layer 3DNEPH database and consists of total cloud amount, low cloud type and amount, middle cloud type and amount, and high cloud type and amount. Analyses are on a 512 x 512 subset of the eighth-mesh grid and include data for both hemispheres eight times a day on each synoptic hour (but only 03, 09, 15, and 12 Z for Southern Hemisphere data).
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
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Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Aerosols	25 nmi	15 layers	3 hr
Clouds	25 nmi	15 layers	3 hr
Fog	25 nmi	15 layers	3 hr
Precipitation	25 nmi	15 layers	3 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	546
Model or DB Title	High Resolution Analysis
Description	The HIRAS database consists of surface to upper-air analyses data on the 2.5 x 2.5-degree grid. Each analysis includes all mandatory pressure levels (surface, 1000, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 mb). Analysis times are 00 Z, 06 Z, 12 Z, and 18 Z. The database is subdivided into five regions by latitude belt. Although HIRAS is the primary model, the MULTAN model is used for moisture analyses. Data source include conventional surface observations, upper-air soundings, and satellite data. The data elements are temperature, dew point depression, specific humidity, relative humidity, sea-level pressure, U-wind component, V-wind component, D-value, precipitable water, tropopause pressure, tropopause height, tropopause temperature, and vorticity.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	2.5x2.5	16 levels	6 hr
Dew Point Temperature	2.5x2.5	16 levels	6 hr
Humidity	2.5x2.5	16 levels	6 hr
Sea Level Pressure	2.5x2.5	16 levels	6 hr
Temperature	2.5x2.5	16 levels	6 hr
Winds	2.5x2.5	16 levels	6 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	547
Model or DB Title	Eighth-Mesh Surface Temperature Analysis
Description	The surface temperature analysis consists of analyses of surface temperatures (in Kelvin to tenths) on a 512 x 512 subset of the eighth-mesh grid. It is produced eight times daily on each synoptic hour. Analyses serve as background data for comparison with new satellite data to locate relatively cold areas that represent clouds. Analyses use latest surface observations and synoptic reports updated every 3 hr for land areas and every 12 hr (or more) for ocean areas. Temperatures represent ambient air temperatures over land and sea surface temperatures over the ocean.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature	25 nmi	15 layers	3 hr

Tracking No.	548
Model or DB Title	Boundary Layer Window Analysis (BLWA)
Description	The BLWA consists of boundary layer window analyses on the half-mesh grid for Asia, Europe, and the United States. Analysis times are 00 Z and 12 Z. Window sizes are 29 x 27 for the United States and 29 x 35 for Asia and Europe. Each grid point consists of data for the following eight levels: surface, 50, 150, 300, 600, 900, 1,200, and 1,600 m above ground level. Data sources include conventional surface reports and upper air soundings. The data elements are U-wind component, V-wind component, W-wind component, temperature, D-value, height above mean sea level, specific humidity, specific moisture, relative humidity, U-component of fractional wind field, and the V-component of fractional wind field.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity	103 nmi	8 layers	2 hr
Temperature	103 nmi	8 layers	2 hr
Winds	103 nmi	8 layers	2 hr

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	549
Model or DB Title	Upper-Air Window Analyses (UAWA)
Description	The UAWA and a surface analysis are stored on the half mesh grid for Asia, Europe, and North America. Analyses times are 00 Z and 12 Z. Window sizes are 37 x 39 for North America and 35 x 41 for Asia and Europe. Each North American grid point has data for 11 levels: surface, 1000, 850, 700, 500, 400, 300, 250, 200, 150, and 100 mb. Each Asian and European grid point has data for six levels: surface, 1,000, 850, 700, 500, and 300 mb. Two stability indices also included: Total-Totals and SWEAT index. Data sources include conventional surface reports, upper air soundings, and satellite data. The data elements are U-wind component, V-wind component, D-value, temperature, dew point depression, surface pressure, Total-Totals index, and the SWEAT index.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
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Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature	103 nmi	11 layers	2 hr
Static Pressure	103 nmi	11 layers	2 hr
Temperature	103 nmi	11 layers	2 hr
Winds	103 nmi	11 layers	2 hr

Tracking No.	550
Model or DB Title	Vertical Velocity Analysis
Description	Consists of vertical velocity analyses (in millibars per second) on the whole-mesh octagon grid. Analyses available north of about 20°N latitude and south of about 20°S latitude for hours of 00 Z and 12 Z. Data sources are upper-air observations. Levels included are 850 mb, 700 mb, 500 mb, 300 mb, 200 mb, and 150 mb. Available from the High Resolution Analysis for the time period after 1988.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds	206 nmi	6 layers	12 hr

Air Force

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	551
Model or DB Title	Snow Depth Climatology
Description	This product provides mean monthly snow depth values on the polar stereographic one-eighth mesh grid (approximately 25 nmi spacing) over the entire globe.
Organization	USAFETAC/OL-A
Point of Contact	Mr. Jonathan Whiteside
Address–Line 1	151 Patton Ave
Address–Line 2	Room 120
Location	Asheville, NC 28801-5002
Phone Number	704 271-4299

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	25 nmi	NA	Daily

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	554
Model or DB Title	Jacchia Atmospheric Density (JAD) Model, 1970
Description	The JAD Model provides the neutral density atmosphere density for the special perturbation (e.g., Gauss-Jackson) orbit determination model and semi-analytical (e.g., SALT) orbit determination models. These models are used only for high-interest satellites and re-entering debris, which make up only a small percentage (~1%) of the cataloged satellite population.
Organization	Space Warfare Center (SWC)/SAA
Point of Contact	Mr. Mark Storz
Address	730 Irwin Ave.
Location	Falcon AFB, CO 80911-7300
Phone Number	719 380-3550
E-mail Address	storzmf@fafb.af.mil

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Geomagnetic Field	N/A	N/A	5400 s
Solar Parameters	N/A	N/A	86400 s

Air Force

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	555
Model or DB Title	Space Environmental Specification and Forecast System (SESFS)
Description	The SESFS is a system of coupled space models to produce the specification and forecasts (hours though years) of solar, ionospheric, and geomagnetic parameters that effect high-frequency communications and satellite communications. The M&S effort is also used for near real-time and post analysis of radar signatures, satellite anomalies, and communication descriptions.
Organization	50 Weather Squadron
Point of Contact	Mr. Kevin Sro
Address	715 Keplar Ave.
Location	Falcon AFB, CO 80912-7160
Phone Number	719 567-6332

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	5000	N/A	300 s
Refractivity	100 km	10 km	1800 s

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Auroral Particle	0.5°	N/A	1 s
Cosmic Rays	N/A	N/A	1 s
Energetic Parameters	1° deg solid angle	500,000 m	300 s
Geomagnetic Storms	N/A	N/A	900 s
Interplanetary Medium	100,000 m	N/A	900 s
Low Energy Plasma	10,000 m	10,000 m	1800 s
Neutral Environment	25,000 m	3,000 m	3600 s
Polar Cap Absorption	10,000 m	N/A	900 s
Solar Parameters	N/A	N/A	1 day
Sporadic E	10,000 m	3,000 m	900 s
Sudden Ionospheric Storms	N/A	N/A	900 s

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	556
Model or DB Title	Celestial Background Scene Descriptor (CBSD)
Description	The CBSD is a model of the sun, moon, planets, and zodiacal emissions, which include bands, asteroids, stars, and H II regions. Positional accuracy is 2 arc seconds.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Dr. Frank Clark
Address–Line 1	PL/GPOB
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-4139
E-mail Address	fclark@plh.af.mil

Specific Capabilities and Fidelity

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Diffuse Zodiacal Emission	any	any	any
Lunar Parameters			
Meteoroids and Debris	any	any	any
Neutral Environment	any	any	any
Solar Parameters	any	any	any
Star and Planetary Positions	any	any	any

Tracking No.	557
Model or DB Title	AFGL-TR-89-0012, Effects of Rain Attenuation on Satellite EHF Communications in the United States
Description	AFGL-TR-89-0012 provides estimates of the frequency of occurrence, duration, and probability of satellite EHF communication outages due to attenuation by rain. These can be used to determine optimum frequencies, power levels, and the need for space diversity of terminals or other alternatives to maintain reliable communications. Ten years of 1-min rain rates at each of 42 United States cities were used in conjunction with an attenuation model to quantify communication outages at locations representing a variety of climatic regimes. Analyses of the 1-min rain rates and outage estimates at 15, 30, and 45 GHz for elevation angles of 10°, 30°, 50°, and 70° are presented. The results show the profound influence of propagation path elevation angle on the quantity and duration of outages.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Mr. Paul Tattelman
Address–Line 1	PL/GPAA
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01713-3010
Phone Number	617 377-5956

Tracking No.	558
Model/DB Title	A Climatological Model for 1-min Precipitation Rates
Description	The article (Journal of Applied Meteorology, Vol. 34. No. 5, May 1995) describes a model for estimating mean monthly total time occurrence for 1-min precipitation rates from monthly climatological variables. The model has two components: an estimation algorithm for the mean monthly percentage of time in which precipitation occurs and a set of algorithms to derive the mean cumulative distribution function of precipitation rates for a calender month. Both components were developed using stepwise linear regression analysis applied to a database containing 10 yr of 1-min precipitation data from 34 sites throughout the 48 contiguous states of the United States. The required climatological variables are mean monthly temperature range, mean monthly precipitation, and mean number of days per month with precipitation (based on three commonly used threshold values to define a day with precipitation).
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Mr. Paul Tattelman
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Tracking No.	559
Model or DB Title	Drop-Size Distribution Associated with Intense Rainfall
Description	Willis and Tattleman (Journal of Applied Meteorology, Vol. 28. No. 1, January 1989) review the probability of occurrence of extreme rainfall rates. The drop-size distributions associated with a range of high rainfall rates are examined using data from tropical storms and hurricanes. Mean drop-size distributions are presented for a range of high rainfall rates, as well as a Gamma distribution to fit the entire set of normalized drop-size distributions. This fit forms the basis for a model drop-size distribution for intense rain. The goodness of fit of the model is examined by comparing it with independent drop-camera measurements of high-rain-rate distributions from several geographic locations. The slope of exponential fits to the distributions are examined for constancy with rainfall rate and are generally found to decrease with increasing rainfall rate.
Organization	NOAA/AOML
Point of Contact	Mr. Paul Willis
Address–Line 1	Hurricane Research Division
Location	Miami FL 33149

Tracking No.	560
Model or DB Title	Military Standard 210C, Climatic Information to Determine Design and Test Requirements for Military Systems and Equipment (MIL-STD-210C)
Description	Military Standard 210C superseded MIL-STD-210B in January 1987 to include not only worldwide data but also regional climatic data. The data provided are intended to serve as natural environmental starting points for the sequence of engineering analyses to derive environmental design criteria for military material. The current standard provides climatic information for land, sea, and air environments in which military material may be required to operate. The information is generally presented in the form of frequencies of occurrence; however, long-term climatic extremes are also provided for most climatic elements.

Tracking No.	561
Model or DB Title	Universal Methods for Estimating Probabilities of Cloud-Free Lines-of-Sight Through the Atmosphere
Description	The paper describes how more than 3 years of 3-hr high-contrast whole-sky photographs, sky-cover observations, and cloud-type observations were utilized to develop two methods for estimating cloud-free line-of-sight probabilities through the entire atmosphere between the surface of the earth and space for any desired geographical location. One method requires a knowledge of the probability of each sky-cover category (tenths or eighths); the other method requires sky-cover and cloud-type information. See I. A. Lund and M. D. Shanklin, 1973: Universal methods for estimating probabilities of cloud-free lines-of-sight through the atmosphere, Journal of Applied Meteorology, Vol. 12, No. 1, February 1973, pp. 28–35.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Mr. Donald Grantham
Address–Line 1	PL/GPAA
Address–Line 2	29 Randolph Rd.
Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2982
E-mail Address	grantham@plh.af.mil

Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	562
Model or DB Title	Estimating Probabilities of Cloud-Free Fields-of-View (CFFOV) From the Earth Through the Atmosphere
Description	The paper describes a model for estimating the probability of obtaining a cloud-free field-of-view for earth-to-space viewing application as a function of ground-observer-reported total sky cover. The development of the model and examples of its application are described. The model extends the work of Lund and Shanklin (1972, 1973) on cloud-free lines-of-sight by presenting probabilities of the CFFOV. Examples of the types of questions bearing on the CFFOVs addressed in this study are: What is the probability that there will be a CFFOV directly overhead, from the earth's surface to space, if the FOV width is 10°? How does the probability change as the FOV is widened? What is the probability that at least half of the FOV will be cloud-free? How does it change if the FOV axis is moved off the zenith? How do these CFFOV results compare to the CFLOS results published earlier? See I. A. Lund and D. D. Grantham, 1980: Estimating probabilities of cloud-free fields-of-view from the earth through the atmosphere, Journal of Applied Meteorology, Vol. 19, No. 4, pp. 452–463, April 1980.
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Mr. Donald Grantham
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Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	563
Model or DB Title	Clear and Cloud-Free Lines-of-Sight From Aircraft (Addendum)
Description	AFGL-TR-77-0141 (Addendum), 8 August 1977 (Reprinted 6 September 1983) by Eugene A. Bertoni, provides estimates of probability of clear, cloud-free, and hazy lines-of-sight to and from aircraft at altitude. This reports allows the following types of questions to be answered: What is the probability of seeing an object on the ground from various altitudes, in specified geographical areas and at different seasons? How high must one fly to be 98% confident of being above all clouds? What is the probability of successful IR or optical detection of an aircraft or surface target from an aircraft flying above all clouds?
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Mr. Donald Grantham
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Air Force

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	564
Model or DB Title	Atlas of Cloud-Free Line-of-Sight Probabilities, Parts 1–5: Northern Hemisphere
Description	These atlases provide probabilities of cloud-free lines-of-sight between earth and space. The probabilities are for mid-season months: January, April, July, and October; four times a day: 0000–0200 LST, 0600–0800 LST, 1200–1400 LST, and 1800–2000 LST; and three elevation angles: 10°, 30°, and 90°. Parts 1, 2, 3, 4, and 5 depicted cloud-free line-of-sight probabilities for Germany, the U.S.S.R., the U.S.A., Europe, and North Africa and the Middle East, respectively. See I. A. Lund, D. D. Grantham, and C. B. Elam, Jr., "Atlas of Cloud-Free Line-of-Sight Probabilities", Parts 1–5: Part 1: Germany. AF Surveys in Geophysics No. 309, AFCRL-TR-0261, 77 pp., May 1975. Part 2: Union of Soviet Socialist Republics, AF Surveys in Geophysics No. 358, AFGL-TR-77-005, 63 pp., December 1976. Part 3: United States of America, AF Surveys in Geophysics No. 374, AFGL-TR-77-188, 73 pp., August 1977. Part 4: Europe, AF Surveys in Geophysics No. 400, AFGL-TR-78-0276, 71 pp., November 1978. Part 5: North Africa and the Middle East, AF Surveys in Geophysics No. 417, AFGL-TR-79-0275, 67 pp., November 1979.
Organization	Phillips Laboratory Geophysics Directorate
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Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2982
E-mail Address	grantham@plh.af.mil

Tracking No.	566
Model or DB Title	Probability-of-Cloud Statistics (P Cloud S)
Description	P Cloud S is a PC-based, compact global cloud climatology model of total sky cover (not clouds at a given altitude).The following statistics together with estimated errors are available for any point on the earth, any time of year, and any time of day in the form of numbers, graphs, histograms, or maps: Sky Cover (probability of given fraction, duration category, recurrence category, and conditional climatology); Cloud-Free Line-of-Sight (probability of CFLOS, duration of CFLOS, recurrence of CFLOS, and joint probability of CFLOS at N sites); Satellite-based Viewing (cloud coverage over an area and cloud coverage over a line); and Database Parameters (mean sky cover, sky dome mean correlation, large area mean correlation, and effective period of record).
Organization	Phillips Laboratory Geophysics Directorate
Point of Contact	Mr. Albert Boehm
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Location	Hanscom AFB, MA 01731-3010
Phone Number	617 377-2971
E-mail Address	boehm@plh.af.mil

Tracking No.	601
Model or DB Title	PEGASUS
Description	The PEGASUS Perspective View Database (PVDB) is a geographic database containing elevation data, gray shades taken from aerial photographs, vegetation heights, and other information required for perspective view generation. The PVDB is available in four resolutions: 1, 4, 16, and 64 m. The Fort Hunter-Liggett (FHL) PVDB covers a rectangular area on the ground measuring 32 x 28 km.
Organization	Computer Science Department
Point of Contact	Dr. Wolfgang Baer
Address–Line 1	Naval Postgraduate School
Location	Monterey, CA 93943
Phone Number	408 656-2209
E-mail Address	baer@cs.nps.navy.mil

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	609
Model or DB Title	Synthetic Environments (SE)
Description	SE introduces within the synthetic theater of war (STOW-97) improved entity resolution and performance; environmental representations; and integrated, distributed live, virtual, and constructive simulations. SE develops knowledge-based, semi-autonomous forces and faster database builds.
Organization	Topographic Engineering Center
Point of Contact	Mr. Jack Huntley
Address–Line 1	Attn: CETEC-TD-SM (Huntley)
Address–Line 2	7701 Telegraph Rd.
Location	Alexandria, VA 22315-3864
Phone Number	703 355-2651
E-mail Address	jhuntley@tec.army.mil

Tracking No.	610
Model or DB Title	Smart Weapons Operability Enhancement (SWOE)
Description	The SWOE provides environmental and target radiometric information at the aperture of an electro-optical sensor. The model also has the capability to simulate the sensor transform function. The SWOE program has also collected and developed an extensive environmental database consisting of MWIR (3–5 μm), LWIR (8–12 μm), and MMW (95.0 GHz) imagery from both ground and airborne platforms for Grayling, MI, during the fall and winter, and at Yuma, AZ, during the spring. The total database is larger than one terabyte.
Organization	CRREL
Point of Contact	Dr. George Koenig
Address–Line 1	CECRL-SW
Address–Line 2	72 Lyme Rd.
Location	Hanover, NH 03755
Phone Number	603 646-4556
E-mail Address	gkeonig@crrel41.usace.army.mil

Tracking No.	612
Model or DB Title	BITS–Broadband Integrated Transmittances
Description	BITS calculates transmittances for systems having a broad spectral response. Path-integrated concentration data from COMBIC calculations or other EOSAEL models can be used as input to BITS. The primary function of BITS is to provide rigorous transmittance calculations for broadband systems, replacing the Lambert-Beer law used in most obscuration calculations. The user of the model must define the system detector, filter, optics, and source spectral functions. The spectral transmittance of the atmosphere and the mass-extinction-coefficient spectral data for the obscurant are also needed for BITS calculations. The output of BITS is the resulting transmittance as a function of concentration length for Beer's law and the band-averaged computational methods. Details about the model are described in the Users Guide by Davis and Berrick. The rationale for developing this model was that errors in using the simple Lambert-Beer law could result in the accumulation of errors in transmittances for war games, and so change the outcome of such war games.
Organization	US Army Research Laboratory
Point of Contact	Dr. Alan Wetmore
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	613
Model or DB Title	CLIMAT–The Climatology Model
Description	CLIMAT is a support module used by several of the other EOSAEL models. It can also be used to describe the climatological aspects of a region. The CLIMAT database is built from meteorological data from hundreds of Air Force and other stations and is averaged and statistically manipulated to give predictive meteorology for 74 areas throughout the world. These areas are Central Europe (1–4), Mid-East (5–10), Korea (11–13), Alaska (14–16), Scandinavia (17–18), Central America (19–21), Mexico (22–25), South America (26–31), India (32–34), Southeast Asia (35), Southern Europe (36–47), and Canada and U.S.A. 48–74). Three-hourly observations from 1965 to the present were used to compute the climatology data for the regions. CLIMAT contains conditional statistics based on prevailing weather conditions. The seasons were determined from time changes in these conditional statistics.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	100 km	N/A	6 hr
Dew Point Temperature	100 km	N/A	6 hr
Humidity	100 km	N/A	6 hr
Precipitation	100 km	N/A	6 hr
Sea Level Pressure	100 km	N/A	6 hr

Tracking No. 613 (Continued)

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature	100 km	N/A	6 hr
Visibility	100 km	N/A	6 hr
Winds	100 km	N/A	6 hr

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	614
Model or DB Title	COMBIC–Combined Obscuration Model for Battlefield Induced Contaminants
Description	COMBIC predicts the reduction in transmission of electromagnetic energy at visual, near-infrared, and far-infrared wavelengths due to airborne dust, smoke, and debris added to a battlefield environment, and obscurant sources for arbitrary times after cloud formation. Vehicular dust is also included.
Organization	US Army Research Laboratory
Point of Contact	Dr. Alan Wetmore
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Combat-generated Dust	1 m	1 m	1 s
Smoke	1 m	1 m	1 s
Transmissivity	1 m	1 m	1 s

Tracking No.	615
Model or DB Title	COPTER–Obscuration Due to Helicopter Lofted Snow and Dust Module
Description	COPTER models obscuration produced by helicopter lofted snow and dust, based on a combination of helicopter downwash models and models of obscuration by blowing snow. The helicopter can be traveling across the line of sight or parallel to the line of sight. Broadband transmission is calculated for the visible and scaled to the infrared and millimeter wave regions. Outputs are minimum transmission and time periods when transmission is less that 5% for all wave bands.
Organization	US Army Research Laboratory
Point of Contact	Dr. Alan Wetmore
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

Tracking No.	616
Model or DB Title	FASCAT–Atmospheric Illumination Module
Description	FASCAT is a two-stream approximate radiative transfer model. The model was mainly developed by the US Air Force and Navy, and this version was especially adapted for the US Army EOSAEL. The reason for using an approximate radiative transfer model is to make quick but reasonably accurate path radiance or contrast calculations. A model of this type can be used to calculate a quantity called sky-to-ground ratio that is used in war games considering visual or near visual devices. The atmosphere is characterized in layers that have specified absorption and scattering characteristics. Phase functions for the aerosols are built into the block data routine within FASCAT.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	10 m	10 m	10 min
Transmissivity	1 m	1 m	1 s

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	617
Model or DB Title	FITTE–The Fire Induced Transmission and Turbulence Effects Module
Description	The FITTE and FGLOW models provide relatively rapid calculations of the effects of battlefield fires on detection, laser-designator, and weapon systems. FITTE predicts transmittance through fire plumes, path radiance from fires or fire plumes and (optionally) effects of fire or fire plume turbulence on laser propagation for a given line of sight. The fires represent localized sources of burning diesel fuel, motor oil, and rubber, i.e., simulated burning vehicles. FITTE also predicts the line-of-sight path-integrated particle concentration, and if a target temperature is specified, the attenuated thermal radiance from the target at the observer position. If the calculation is performed for a single wavelength, the model predicts beam spread and wander on a laser beam of that wavelength. The FGLOW option performs calculations for a set of lines of sight and creates a file of path radiance values, which represent the radiant image that would be seen by an imaging system, and of transmittance values, which represent the attenuation of the background image. An option allows output of an apparent temperature image.
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	10 m	10 m	10 min
Smoke	1 m	1 m	1 s
Transmissivity	1 m	1 m	1 s

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	618
Model or DB Title	GRNADE–Self-Screening Applications Module
Description	GRNADE models transmission through smoke screens are produced by multiple round salvos of tube-launched L8A1 and M76 self-screening grenades. Some aspects of atmospheric diffusion are treated, optical properties of screens are treated, and burst patterns of salvos can be varied. GRENADE specifically addresses inventory systems; however, the model can be adjusted slightly for developmental systems.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

E[2]DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	619
Model or DB Title	ILUMA–Natural Illumination Under Realistic Weather Conditions
Description	The ILUMA model provides solar and lunar positions, as well as the natural illumination in lumens per square meter and watts per square meter under realistic atmospheric conditions. The model is a simple 2-stream radiative transfer model with three layers of atmosphere. The illumination is the total sum of the sun, moon, and background sky. The solar and lunar model is Berkove's algorithm for dates between January 1, 1977, and December 31, 1999.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	1 km	surface	10 min

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	620
Model or DB Title	KWIK–A Munition Expenditures Module
Description	KWIK predicts the number of smoke munitions required to reduce the probability of target detection to a given level. KWIK also calculates the projectile impact separation, number of rounds, total expenditures, and rate of fire required to form and maintain a chemical smoke screen of desired length and duration.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

Army

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	621
Model or DB Title	LASS–Large Area Screening Systems Application Module
Description	LASS uses extensive preprogrammed look-up tables and novel scaling techniques to account for effects of single and multiple scattering to compute both the direct and diffuse components of radiation propagated along arbitrary slant paths and horizontal lines of sight. From this output other quantities required for target acquisition, such as contrast transmission and surface irradiance, can be calculated.
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	10 m	10 m	10 min
Transmissivity	1 m	1 m	1 s

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	622
Model or DB Title	LOWTRN–Atmospheric Transmittance/Radiance Module
Description	LOWTRN calculates sensor-weighted atmospheric transmittance and/or thermal emission at moderate spectral resolution along specified paths through eight standard model atmospheres, a user-specified model atmosphere, or a set of meteorological conditions. This version of the module also calculates contrast. It is applicable to broad-band calculations only.
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Radiative Features	10 m	10 m	10 min
Transmissivity	1 m	1 m	1 s

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	623
Model or DB Title	LZTRAN–Laser Transmittance Module
Description	LZTRAN calculates molecular absorption coefficients and transmittances for 97 specific laser frequencies ranging from the visible to the far infrared. Absorption coefficients and transmittances may be calculated for horizontal or slant paths between sea level and 5.0 km.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	624
Model or DB Title	MPLUME–Missile Smoke Plume Obscuration Code
Description	MPLUME predicts the location and spread of the plume from a Hellfire missile and the transmittance at visible, 1.06, 3–5, and 8–12 μm along any line of sight near the plume. Radiance at 8–12 μm is also calculated. This code predicts the performance of a TADS designator system under various conditions and can be used for planning field tests. The code is based on curve fits to result from a detailed plume calculation code and on an adaptation of a Gaussian plume model. MPLUME simulates TADS/HELLFIRE designation of battlefield targets from attack helicopters.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

Army

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	625
Model or DB Title	NBSCAT–Narrow Beam Multiple Scattering Module
Description	NBSCAT is a multiple scattering propagation model applicable to narrow light beams transmitted through aerosol clouds. The module calculates the transmitted and backscattered irradiance profiles as functions of the field of view, and the on-axis transmitted power and lidar returns for specified receiver geometries. The algorithm is based on the radiative transfer model described by Bissonnette (1988) and validated against laboratory data as reported in Bissonnette, Smith et al. (1988).
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

E2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	626
Model or DB Title	NMMW–Near Millimeter Wave Module
Description	NMMW calculates for frequencies from 10 GHz to 1000 GHz the attenuation due to water vapor and oxygen absorption; cloud, fog, and ice fog bulk attenuation; rain and snow extinction; backscatter cross section for clouds, fog, ice fog, rain, and snow; and refractivity for oxygen and water vapor. Transmission over a specified path is also computed.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity	100 m	100 m	10 min
Transmissivity	1 m	1 m	1 s

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	627
Model/DB Title	NOVAE–Nonlinear Aerosol Vaporization and Breakdown Effects Module
Description	NOVAE calculates both the aerosol breakdown and vaporization effects on high energy laser (HEL) propagation in the repetitive pulse mode, but only the aerosol vaporization effects in the continuous wave mode. Linear and nonlinear effects are included in the calculation of beam area and intensity.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity	100 m	100 m	10 min
Transmissivity	1 m	1 m	1 s

Army

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	628
Model or DB Title	OVRCST–Contrast Transmission Module
Description	OVRCST calculates beam transmittance, path radiance, and contrast transmittance along an arbitrary line of sight under an overcast sky. The program provides either thermal or single scattering calculations or path radiance, depending on the value of the atmospheric temperatures.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

Tracking No.	629
Model or DB Title	PFNDAT–Aerosol Phase Function Database
Description	PFNDAT contains phase functions, extinction and scattering coefficients, and the single-scattering albedo for 30 naturally-occurring aerosols, and 8 manmade aerosols for use with EOSAEL modules, or any routine that needs such data. The naturally-occurring aerosols consist of the maritime, urban, and rural aerosol-size distributions at eight relative humidities and two fog distributions (all consistent with those in LOWTRN), and rain and snow distributions. The manmade aerosols consist of three dust types, including a high-explosive distribution; white phosphorus at three relative humidities; hexachloroethane; and oil smoke. The database includes information for each aerosol at wavelengths ranging from 0.55 to 40.0 μm.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	630
Model or DB Title	RADAR–Millimeter Wave System Performance Module
Description	RADAR calculates the system performance of various radars under different atmospheric conditions. In this way the modeler can see how different millimeter wave radars react to various atmospheric parameters.
Organization	US Army Research Laboratory
Point of Contact	Dr. Alan Wetmore
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity	100 m	100 m	10 min
Transmissivity	1 m	1 m	1 s

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	631
Model or DB Title	REFRAC–Optical Path Bending Code Module
Description	The REFRAC module calculates the amount of curvature a ray of light experiences as it passes over a complex terrain surface, and thus calculates the refraction effects on lines of sight near ground level.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity	1 m	1 m	1 hr

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	632
Model or DB Title	SCAFFIP–Scanning Fast Field Program Module
Description	SCAFFIP is based on the Fast Field Program (FFP) with the added ability to scan multiple azimuths when predicting the propagation conditions about the location of a sensor. SCAFFIP makes a prediction of the acoustic propagation conditions based on spherical spreading, molecular absorption, refraction, acoustically complex ground impedance, and diffraction over benign terrain. The FFP is a one-way solution to the acoustic wave equation, originally developed for underwater sound propagation predictions. It uses a propagation matrix formulation. By viewing each layer in the atmosphere as an optical device, a matrix for each layer can be constructed. Multiplying each matrix together results in a new matrix that represents how an acoustic signal will be affected as it propagates through the atmosphere. The next step is to take a Bessel Function Transform of the problem with respect to range. After the solution is calculated, an inverse transform is performed to arrive at the final solution.
Organization	US Army Research Laboratory
Point of Contact	Mr. David Marlin
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Phone Number	505 678-5447
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E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	633
Model or DB Title	TARGAC–Target Acquisition Model
Description	TARGAC will evaluate the combined effects of target-background contrast, atmospheric transmission, and sensor performance on the range at which a target can be detected and/or recognized by an imaging device. It calculates range as a function of the probability of detection, recognition, and weather.
Organization	US Army Research Laboratory
Point of Contact	Dr. Alan Wetmore
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

Army

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	634
Model or DB Title	UVTRAN–An Ultraviolet Transmission and Lidar Simulation Module
Description	UVTRAN is an atmospheric transmission and lidar return calculation module for visible and ultraviolet (UV) wavelengths. This EOSAEL module combines three codes: a transmission code suitable for use in the visible and UV regions, a backscatter code for Mie and fluorescence lidar return calculations, and a sky background radiance code. The result is a modular, menu-driven, user-friendly FORTRAN program.
Organization	US Army Research Laboratory
Point of Contact	Dr. Alan Wetmore
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

Tracking No.	635
Model or DB Title	XSCALE–Natural Extinction Module
Description	XSCALE calculates the extinction and transmittance through naturally occurring aerosols (haze and fog), rain, and snow for horizontal paths, slant path extinction for haze and fog, and absorption and scattering coefficients for haze over horizontal paths. Computations are performed for both individual wavelengths and broadband averages (with optional filter response function) for arbitrary slant paths.
Organization	US Army Research Laboratory
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Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	636
Model or DB Title	SCAPE–Scanning Parabolic Equation
Description	SCAPE is based on the Green's Function Parabolic Equation (PE), a split-step PE that incorporates complex ground impedance. SCAPE scans multiple azimuths to generate a quasi-three-dimensional footprint for an acoustic source or sensor. SCAPE uses spherical spreading, complex ground impedance, molecular absorption, and refraction due to wind and temperature profiles to predict transmission loss as a function of range, height, and azimuth.
Organization	US Army Research Laboratory
Point of Contact	Mr. David Marlin
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Tracking No.	637
Model or DB Title	NAPS–Noise Assessment and Prediction System
Description	NAPS utilizes a ray trace model coupled with terrain features and graphics to provide users with a visual display of noise levels on the surrounding community that may result from operations such as artillery firings and detonations.
Organization	US Army Research Laboratory
Point of Contact	Mr. David Marlin
Address–Line 1	Battlefield Environment Directorate
Address–Line 2	AMSRL-BE-S (ATTN: Dave Marlin)
Location	White Sands Missile Range, NM 88002-5501
Phone Number	505 678-5447
E-mail Address	dmarlin@arl.mil

Tracking No.	638
Model or DB Title	Spherical–Ground impedance model based on equations by Attenborough
Description	Spherical uses the ground impedance model developed by Attenborough to predict how sound will propagate over a given surface.
Organization	US Army Research Laboratory
Point of Contact	Dr. John Noble
Address–Line 1	Battlefield Environment Directorate
Address–Line 2	AMSRL-BE-S (ATTN: John Noble)
Location	White Sands Missile Range, NM 88002-5501
Phone Number	505 678-3751
E-mail Address	jnoble@arl.mil

Tracking No.	639
Model or DB Title	AGAUS–A Mie Code
Description	AGAUS is a computer program to calculate the single scattering of electromagnetic radiation of a plane wave by a dielectric sphere or polydistributions of spheres using Mie Theory. AGAUS will calculate extinction, scattering, and backscattering coefficients, and (optionally) phase functions for polydisperse distributions of spherical aerosol particles. The phase functions are normalized so that their integral over all solid angles is unity. Humidification effects on aerosols can be included through the Gottfried Hanel aerosol growth formulas that calculate changes in radii and complex refractive indices. In general, the user will have to supply the real and imaginary parts of the complex refractive index of the particle, the radius of the particle in micrometers, and the incident wavelength of the particle size distributions. The output will be the Mie extinction, scattering and efficiency coefficients, and the backscattering coefficient. The scattering phase functions can be output as well, if the user so desires.
Organization	US Army Research Laboratory
Point of Contact	Dr. Alan Wetmore
Address–Line 1	ATTN: AMSRL-BE-SA (Dr. Wetmore)
Address–Line 2	2800 Powder Mill Road
Location	Adelphi, MD 20783
Phone Number	301 394-1360
E-mail Address	awetmore@arl.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	1 m	1 m	1 s

Tracking No.	701
Model or DB Title	Seakeeping Evaluation Program (SEP) Wind and Wave Database
Description	The Seakeeping Evaluation Program (SEP) Wind and Wave Database is a condensed version of the Spectral Ocean Wave Model (SOWM), hindcast wind, and wave climatic databases for the open ocean, North Atlantic, North Pacific, and Indian Oceans. Hydrodynamic characteristics that are altered by the wind and wave environment include seakeeping, maneuvering, powering, water and air wake, stack gas dispersion, and seaway loads on the ship structure.
Organization	Naval Surface Warfare Center
Point of Contact	Mrs. Kathryn McCreight
Address–Line 1	Commander, Carderock Division
Address–Line 2	Code 562, NSWC
Location	Bethesda, MD 20084-5000
Phone Number	301 227-1242
E-mail Address	kmccreig@oasys.dt.navy.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity	SOWM	N/A	N/A

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	702
Model or DB Title	Orbit Determination Program (ODP)
Description	ODP software is used to compare operational orbits for Navy-operated spacecraft such as Transit. The ODP software is being upgraded to satisfy GEOSAT follow-on GFO mission requirements. Each version (old and new) of the ODP requires similar environmental input.
Organization	Naval Space Command
Point of Contact	CDR Tim Barock
Address	N513
Location	Dahlgren, VA 22448
Phone Number	703 663-7591

Navy

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	703
Model or DB Title	Tactical Environmental Knowledge Base System (TEKBS)
Description	TEKBS relates environmental sensitivities of weapon systems to environmental parameters that can be observed by space sensors. The software is not operational.
Organization	Naval Space Command
Point of Contact	CDR Tim Barock
Address	N513
Location	Dahlgren, VA 22448
Phone Number	703 663-7591

E[2]DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	704
Model or DB Title	Submarine Technological Environmental (STE) Database–Clouds
Description	There are ~50 oceanographic, geological, meteorological (including clouds), and bathymetric databases.
Organization	Johns Hopkins University
Point of Contact	Ms. Christina Myles-Tochko
Address–Line 1	Applied Physics Laboratory
Address–Line 2	Johns Hopkins Road
Location	Laurel, MD 20723-6099
Phone Number	301 953-6603

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	200 km	6 levels	2 weeks

E[2]DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	705
Model or DB Title	Navy Operational Regional Atmospheric Prediction System (NORAPS)
Description	The NORAPS is the only operational mesoscale forecast system used by the Navy at the Fleet Numerical Meteorological and Oceanography Center. The present version is globally relocatable and triple-nested (45, 15, and 5 km), but it is run operationally in a double-nested mode of 45 and 15 km for selected regions of the globe. NORAPS consists of two main modules: one prepares initial and boundary conditions, and the other conducts initialization and produces forecasts. The initial conditions are prepared on 16 standard pressure levels through multivariate optimum interpolation. The forecasts are computed from the primitive equations and physical parameterizations using staggered-C grids on sigma-p levels.
Organization	Fleet Numerical Meteorology and Oceanography Center
Point of Contact	Ms. Liana Zambresky
Address–Line 1	STOP 1
Address–Line 2	7 Grace Hopper Ave.
Location	Monterey, CA 93943
Phone Number	408 656-4311
E-mail Address	zambresk@fnoc.navy.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature	5–45 km	36 levels	1 hr
Humidity	5–45 km	36 levels	1 hr
Mixing Ratio	5–45 km	36 levels	1 hr
Precipitation	5–45 km	36 levels	1 hr
Radiative Features	5–45 km	36 levels	1 hr
Refractivity	5–45 km	36 levels	1 hr
Sea Level Pressure	5–45 km	36 levels	1 hr
Temperature	5–45 km	36 levels	1 hr
Winds	5–45 km	36 levels	1 hr

Tracking No.	706
Model or DB Title	Navy Operational Global Atmospheric Prediction System (NOGAPS)
Description	The NOGAPS is the primary numerical weather prediction (NWP) model supporting worldwide Navy operations. Over the last 15 yr NOGAPS has evolved to keep pace with advances in supercomputer hardware and software; today NOGAPS is one of five world-class NWP models. The current operational system, NOGAPS 3.3, is running on the Fleet Numerical Meteorology and Oceanography Center's Cray C90 twice daily, producing 2500 global atmospheric fields. The data sets support DoD operations, academia, and national laboratories.
Organization	Fleet Numerical Meteorology and Oceanography Center
Point of Contact	Dr. Randal Pauley
Address–Line 1	STOP 1
Address–Line 2	7 Grace Hopper Ave.
Location	Monterey, CA 93943
Phone Number	408 656-4616
E-mail Address	pauly@fnoc.navy.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	80 km	variable	1 hr
Contrail Formation/Dispersion	80 km	variable	1 hr
Dew Point Temperature	80 km	variable	1 hr
Fog	80 km	surface	1 hr
Humidity	80 km	variable	1 hr
Precipitation	80 km	surface	1 hr
Sea Level Pressure	80 km	surface	1 hr
Temperature	80 km	variable	1 hr
Winds	80 km	variable	1 hr
Winds–Specific Features	80 km	variable	1 hr

Tracking No.	707
Model or DB Title	Aircraft Icing (AIRICE)
Description	AIRICE provides an automated aircraft icing assessment from which naval forecasters can predict flight levels that may present hazardous icing conditions. The AIRICE function requires operator input and radiosonde data from the Geophysical Fleet Mission Programming Library (GFMPL) database to produce arrays of lapse rate, stability, icing probability, icing type, and icing intensity. This information is stored in the GFMPL database and is available for display by the forms manager or the graphics handler.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	N/A	N/A	N/A
Dew Point Temperature	N/A	N/A	N/A
Humidity	N/A	N/A	N/A
Temperature	N/A	N/A	N/A

Tracking No.	708
Model or DB Title	Anti-Air Warfare (AAW) Aircraft Stationing Aid
Description	The AAW Program is designed to show the refractive distortion of normal propagation at a user-specified range for various combinations of radar transmitter and target/receiver altitudes. AAW's input consist of maximum radar/transmitter height, maximum target/receiver height, range of the display, and a refractivity data set from the Environmental Data Files (EDFs). The refractivity data set consists of a modified refractive index (M-unit) profile. The primary use of the AAW stationing aid is to assist in the optimum placement of the early warning aircraft radar or the electronic support measure (ESM) receiver. A series of outputs at different ranges can provide a good representation of a three-dimensional assessment of an electromagnet (EM) system's performance.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Tracking No.	709
Model or DB Title	Meteorological Ballistic Winds and Densities Model (BALWIN)
Description	The BALWIN program computes ballistic wind and density correction factors for US Navy and NATO gunfire support. The correction factors are produced in standard US Navy and NATO ballistic message formats. User-specified input includes the duration of the ballistic forecast and a specification of the radiosonde data set, which is retrieved from the Environmental Data Files.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Tracking No.	710
Model or DB Title	Battle Group Vulnerability (BGV)
Description	The BGV program provided estimates of vulnerability of the various platforms in a battle group to a specified electronic support measure system under varying environmental conditions. The vulnerability estimates, depicted as graphics, for an individual platform are expressed as the maximum intercept range of all active emitters on the platform. Intercept ranges for surface-to-air, air-to-air, and air-to-surface geometry can be calculated. The purpose is to minimize the group's vulnerability to counterdetection.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity	N/A	N/A	N/A

Navy

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	711
Model or DB Title	Create Atmospheric Refractive Data Set (CARDS)
Description	The CARDS function is used to create a refractivity data set for placement into the Refractivity Data File, which is used by various electromagnetic propagation programs. The refractivity data set contains a profile of the modified refractive index (M) with respect to height, the height of the evaporation duct, and surface wind speed.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity	N/A	N/A	N/A
Winds	N/A	N/A	N/A

Tracking No.	712
Model or DB Title	Chaff Corridor Density (CCD) Model
Description	CCD determines the number of chaff dispensers, the dispenser settings, and the dispensing aircraft's speed that will produce an effective chaff screen for a given friendly aircraft against a particular threat radar.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Chaff Dispersion	N/A	N/A	1 s

Tracking No.	713
Model or DB Title	Chaff Trajectory Function (CHATRA) Model
Description	CHATRA computes the optimal altitude of the chaff-dispensing corridor and the position for protecting a specified strike corridor, the fall time of the chaff, and the vertical and horizontal displacement of the mean chaff dipole from drop time throughout the fall.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis

Specific Capability and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Chaff Dispersion	N/A	N/A	1 s

Tracking No.	714
Model or DB Title	The Oceanographic and Atmospheric Master Library (OAML) Navy Standard Radar Sea Clutter (CLUTTER) Model
Description	CLUTTER provides a method for determining the average radar sea-clutter cross section as a function of wind speed (or sea state), wind direction relative to the antennae, atmospheric refractive conditions, radar antenna height, frequency, polarization, horizontal beam width, and compressed pulse length. The model provides an output of the average sea-clutter level (db) relative 1 m^2 target vs. target range (km). CLUTTER separates the antennae pattern effects and the environmental effects from the generalized form of the radar equation to provide a model of the average radar sea-clutter cross section.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Tracking No.	715
Model or DB Title	Chaff Dispersion and Density (CHADIS) Model
Description	CHADIS provides a three-dimensional view of the chaff cloud at a specific time after the chaff drop. Containment contours of the dispersed chaff cloud are computed for 90%, 50%, and 10% containment. Chaff dispersion is also represented as radar cross-section density contours.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Chaff Dispersion	0.02 nmi	100 m	N/A

Tracking No.	719
Model or DB Title	D-Values
Description	The D-Values Program accepts radiosonde data from files contained in the Tactical Environmental Support System database. Output consists of arrays of D-values and corresponding heights of standard pressure surfaces.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Navy

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	720
Model or DB Title	Warnings Plot
Description	The Warnings Plot Program consists of three primary functions: the tropical cyclone plot, the high wind plot, and the high seas plot. The Warnings Plot provides the capability for comparing tropical cyclone forecasts and the display of areas of high wind and seas.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds			
Winds–Specific Features			

Navy

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	721
Model or DB Title	Wind Conversion Utility (TRUE WIND)
Description	TRUE WIND provides the capability to convert the wind speed and direction as measured on a moving ship to the true wind, defined as the vector wind relative to a fixed point.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	722
Model or DB Title	Tropical Cyclone Module
Description	The Tropical Cyclone Program tracks tropical cyclone movements and conditions on a user-specified map, and it also provides the capability to enter storm data in the Environmental Data Files (EDF).
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001
Phone Number	
E-mail Address	

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds	N/A	N/A	N/A
Winds–Specific Features	15 nmi	N/A	3 hr

Navy

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	723
Model or DB Title	Tomahawk Land Attack Missile (TLAM) Wind and Temperature Correction
Description	The TLAM Wind and Temperature Correction estimates the TLAM's time-of-flight (TOF) corrections, relative to planned TOF for calm wind and a standard day temperature type, for the effects of winds and temperatures along a given path through a spatially varying atmosphere. Gridded low-level winds and temperatures must be specified for the domain of interest.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature			
Winds			

Tracking No.	724
Model or DB Title	Solar/Lunar Almanac Program (SLAP)
Description	SLAP produces monthly or daily summaries of various sets of ephemeral data for the sun and moon and a light-level planning calendar for the evening sky.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Near Space Data	Horizontal Scale	Vertical Scale	Temporal Scale
Lunar Parameters			
Solar Parameters			

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	725
Model or DB Title	Sound Focus (SOCUS)
Description	The SOCUS program provides a speed of sound profile with respect to height, a profile of maximum explosive noise (peak overpressure) with respect to the range of the explosive source, and the range from the bearing of caustics (sound focal points).
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Nonnuclear Detonation Effects	20 nmi	N/A	N/A
Refractivity	N/A	N/A	N/A
Temperature	N/A	N/A	N/A
Winds	N/A	N/A	N/A

Tracking No.	726
Model or DB Title	Sea-Surface Temperature Analysis and Composite (SSTAC)
Description	The SSTAC function determines sea-surface temperature (SST) patterns for selected areas of interest from satellite imagery collected from the National Oceanic and Atmospheric Administration and Defense Meteorological Satellite Program satellites.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Tracking No.	727
Model or DB Title	Standard Electromagnetic Propagation (Standard EM Prop)
Description	The Oceanographic and Atmospheric Master Library Navy Standard EM Prop model provided the user with a method of assessing EM propagation from 100 MHz to 20 GHz in the marine environment for a variety of atmospheric conditions. The output is a pattern propagation factor (dB), a parameter found in most radar range detection equations.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity			
Transmissivity			

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	728
Model or DB Title	Surface-Search Radar (SRR) Range Table
Description	The SRR Range Table program determines detection ranges of predefined U.S. and Soviet surface targets for SPS-10/SPS-65 and SPS-55 surface-search radars. The output refractivity data set is composed of a profile of modified refractive indices (m-unit) with respect to height, the height of the evaporation duct, and the surface wind speed.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity			

Navy

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	729
Model or DB Title	Tomahawk Anti-Ship Missile (TASM) Effective Wind Model
Description	The TASM Effective Wind Model computes an effective or bogus wind to compensate for the flight (from launch point to search point) of the TASM through a spatially varying wind field, rather than the average or launch-point wind usually used.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature			
Winds			

Navy

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	730
Model or DB Title	Tomahawk Environmental Calculation Aid (TECA)
Description	TECA is designed to automate complex calculations of weighted-mean averages of wind speed and direction and the temperature of the overland flight path of the Tomahawk strike mission.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Precipitation			
Temperature			
Winds			

Navy

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	731
Model or DB Title	Temperature Utility (TEMP UTL)
Description	TEMP UTL provides temperatures and humidity calculations, including comfort temperatures (wind chill and heat stress).
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature			
Humidity			

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	732
Model or DB Title	Tactical/Environmental Ship Routing (TESR)
Description	TESR is a program that computes optimal ship routes and evaluates the costs associated with routing surface ships. It considers tactical parameters such as acoustic and electromagnetic propagation conditions; environmental conditions including ship heave, pitch, and roll; and fuel efficiency.
Organization	Naval Research Laboratory
Point of Contact	Mr. Sam Brand
Address–Line 1	Marine Meteorology Research Division
Address–Line 2	7 Grace Hopper Drive
Location	Monterey, CA 93943-5006
Phone Number	408 656-4748

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds	250 km	N/A	N/A
Winds–Specific Features	250 km	N/A	N/A

E[2]DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	733
Model or DB Title	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
Description	COAMPS is a three-dimensional triple-nested nonhydrostatic atmospheric model and a hydrostatic ocean model that can be run either separately (stand-alone) or integrated (coupled) for high-resolution (<10 km) predictions of the atmosphere and/or ocean. The models can be integrated so that the surface fluxes of heat, momentum, and moisture are exchanged across the air-sea interface at every time step. COAMPS will become operational at the Fleet Numerical Meteorological and Oceanographic Center in mid-1996 in a triple-nested mode (81, 27, and 9 km).
Organization	Naval Research Laboratory
Point of Contact	Dr. Richard Hodur
Address–Line 1	Marine Meteorology Research Division
Address–Line 2	7 Grace Hopper Drive
Location	Monterey, CA 93943-5502
Phone Number	408 656-4788
E-mail Address	hodur@nrlmry.navy.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Clouds	9000 m	10–1000 m	30 s
Dew Point Temperature	9000 m	10–1000 m	30 s
Fog	9000 m	10–1000 m	30 s
Mixing Ratio	9000 m	10–1000 m	30 s
Precipitation	9000 m	10–1000 m	30 s
Radiative Features	9000 m	10–1000 m	30 s
Refractivity	9000 m	10–1000 m	30 s
Sea Level Pressure	9000 m	10–1000 m	30 s
Temperature	9000 m	10–1000 m	30 s
Winds	9000 m	10–1000 m	30 s

E[2]DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	734
Model or DB Title	Direct Method Evaporation Duct (DMED) Model
Description	The DMED model is used to estimate the temperature, humidity, and refractivity profiles at very-high resolution from the sea surface to about 100 m. Output is at a point (a "stick" representation); input is shipboard measurements of air and sea-surface temperature, humidity, and wind speed.
Organization	Naval Research Laboratory
Point of Contact	Mr. John Cook
Address–Line 1	Marine Meteorology Research Division
Address–Line 2	7 Grace Hopper Drive
Location	Monterey, CA 93943-5502
Phone Number	408 656-4785
E-mail Address	cook@nrlmry.navy.mil

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature	0.1 m	sfc–100 m	
Humidity	0.1 m	sfc–100 m	
Refractivity	0.1 m	sfc–100 m	
Sea Level Pressure			
Static Pressure			
Temperature	0.1 m	sfc–100 m	
Winds			

Tracking No.	735
Model or DB Title	Rowland-Rotter Evaporation Duct Model (RRM)
Description	The Rowland-Rotter Evaporation Duct Model provides an estimate of the evaporation duct refractivity profile based on a few shipboard measurements.
Organization	Johns Hopkins University
Point of Contact	Mr. John Rowland
Address–Line 1	Applied Physics Laboratory
Address–Line 2	Johns Hopkins Road
Location	Laurel MD 20723
Phone Number	301 953-6000

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity	N/A	0.1	N/A
Refractivity	N/A	0.1	N/A
Sea Level Pressure	N/A	0.1	N/A
Static Pressure	N/A		
Temperature	N/A	0.1	N/A

Tracking No.	736
Model or DB Title	Tropospheric Electromagnetic Parabolic Equation Routine (TEMPER)
Description	TEMPER describes the propagation of electromagnetic energy in the lower troposphere under specified refractive conditions.
Organization	Johns Hopkins University
Point of Contact	Mr. G. Dockery
Address–Line 1	Applied Physics Laboratory
Address–Line 2	Johns Hopkins Road
Location	Laurel, MD 20723
Phone Number	301 953-5461

Tracking No.	737
Model or DB Title	Electromagnetic Propagation Conditions Summary (PCS)
Description	The Electromagnetic Propagation Conditions Summary graphically depicts refractive conditions of electromagnetic (EM) energy in the atmosphere. Input consists of a refractivity data set composed of an M-unit (modified refractivity) profile with respect to height, the height of the evaporation duct, and the surface wind speed. The output provides the capability to determine the salient characteristics of EM propagation under given atmospheric conditions, assisting in decisions on which EM systems require special consideration for their effective tactical employment.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity			
Winds			

Tracking No.	738
Model or DB Title	Electronic Countermeasures (ECM) Effectiveness Display
Description	The ECM Effectiveness Display program provides a measure of airborne jammer effectiveness against surface-based (victim) radars. Signal strength relative to free space is calculated and displayed with respect to height for five equally-spaced discrete ranges. Inputs consist of the victim radar and jammer of interest, and a refractivity data set from the Meteorological/Electromagnetic (MET/EM) Environmental Data File.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity			

Tracking No.	739
Model or DB Title	Evaporation Duct Height (EDH) Model
Description	The Evaporation Duct Height Model computes evaporation duct height when given the required input: wind speed, air temperature, relative humidity, and sea-surface temperature.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Tracking No.	740
Model or DB Title	Electromagnetic (EM) Coverage Diagram (COVER)
Description	COVER provides a display of radar detection, communication, or sonobuoy coverage in the vertical plane. Input consists of the radar or communication system of interest and its height, the system if airborne, and the refractivity data set from the Refractivity Data File (RDF). COVER provides the capability to determine how a given EM system will perform under given atmospheric conditions in detecting or communicating with a given target or receiver.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity	N/A	1 m	N/A
Transmissivity	N/A	N/A	N/A

Tracking No.	741
Model or DB Title	Electromagnetic (EM) Path-loss vs. Range (LOSS)
Description	The LOSS program provides a display of one-way path loss vs. range or path loss for electronic support measures intercept vs. range. Input consists of data from the RDF, heights of EM transmitter and target or receiver, and data on the user-specified EM system. LOSS provides the capability to assess the performance of the given system under given atmospheric conditions.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Refractivity			
Transmissivity			

Tracking No.	742
Model or DB Title	Electronic Support Measures (ESM) Range Tables
Description	The ESM Range Tables program calculates the maximum intercept ranges of U.S. and Soviet surface emitters by user-specified ESM receivers. Input consists of receiver and emitter characteristics from the database file and a refractivity data set from the Environmental Data Files. The refractivity data set consists of a modified refractive index (M-unit) profile with respect to height, the height of the evaporation duct, and the surface wind speed.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity			

Tracking No.	743
Model or DB Title	Forward-Looking Infrared (FLIR) System Prediction
Description	The FLIR System Prediction program determines the detection, categorization, and identification ranges of airborne sensors against surface targets. Ranges are given as a function of aircraft altitude for a 50% probability of detection, categorization, and identification of the target. The input atmospheric data (height, pressure, temperature, and dewpoint) are provided by the Atmospheric Environmental File (AEF).
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Humidity			
Visibility			
Winds			

Tracking No.	744
Model or DB Title	Historical Electromagnetic Propagation Conditions (HEPC)
Description	The HEPC program generates a climatological electromagnetic propagation condition summary for a user-specified location and month. A historical refractivity data file must be retrieved from the Permanent Data Base (PDB).
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	745
Model or DB Title	High Frequency Communications (HF COMMS)
Description	The HF COMMS program simulates the tactical use of the HF band (2–32 MHz). HF COMMS determines the potential for a hostile force to intercept a transmission, locate a transmitter, or jam a receiver.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity			

Tracking No.	746
Model or DB Title	Historical Wind Speed (HWS)
Description	The HWS data set describes ocean surface wind-speed statistics by month on a geographic grid. The statistics include the 20th, 50th, and 80th percentile, and mean wind speeds and direction for each 45° compass sector.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Navy

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	747
Model or DB Title	HF Lowest Usable Frequency (HF LUF)
Description	The HF LUF model allows simplified HF LUF predictions to be performed in near-real time for user-specified position of receivers and transmitters, the antennae type, date and time, and solar x-ray flux.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity			

Navy

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	748
Model or DB Title	Laser Range Prediction (LRP)
Description	The LRP model displays range information for exposure to low-level laser radiation, both by height vs. range and by difference between day and night. It also displays range vs. time of exposure for different levels of exposure to laser radiation.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature			
Humidity			
Sea Level Pressure			
Temperature			
Visibility			

Tracking No.	749
Model or DB Title	HF Maximum Usable Frequency (HF MUF) Program
Description	The HF MUF program is a semi-empirical model that performs simplified HF MUF near-real-time predictions, given input of user-specified receiver-transmitter positions and solar sunspot number.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity			

Navy

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	750
Model or DB Title	Multivariate Optimum Interpolation (MVOI)
Description	MVOI is a geostrophically constrained analysis of geopotential heights and winds. Input is from various data sources.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Winds	1000 m	200 m	N/A

Tracking No.	751
Model or DB Title	Ooyama Analysis
Description	The Ooyama Analysis interpolates observations to a specified grid using a weighting based on the distance of these observations from the specified grid points.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature			
Sea Level Pressure			
Temperature			

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	752
Model DB Title	Pressure Altitude/Density Altitude (PADA)
Description	The PADA Program provides ranges of pressure and density altitudes, altimeter settings, and sea-level pressures. Input consists of air and dewpoint temperatures, station elevation, 12-hr mean station temperature, and upper-lower station pressure.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Sea Level Pressure			

E^{2}DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	753
Model or DB Title	Pilot Balloon (PIBAL)
Description	The PIBAL Program computes a vertical profile of wind speed and direction based upon the observations provided by a pilot balloon, whose input consist of angles of elevation and azimuth to the balloon at 1-min intervals.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature	N/A	N/A	N/A
Humidity	N/A	N/A	N/A
Sea Level Pressure	N/A	N/A	N/A
Temperature	N/A	N/A	N/A
Winds	N/A	300 m	60 s

Tracking No.	754
Model or DB Title	Platform Vulnerability
Description	Platform vulnerability provides estimates of the vulnerability (maximum intercept range) of the various emitters on a platform to a specified electronic support measure system under varying environmental conditions.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Transmissivity			

Navy

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	755
Model or DB Title	Radiological Fallout (RADFO)
Description	The RADFO model forecasts a pattern of an accumulated dose of radioactivity caused by a specified type of nuclear detonation dispersed by upper level winds. Input includes information on the detonation and an upper wind profile retrieved from Environmental Data Files.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Nuclear Weapons			
Detonation Effects			

Tracking No.	756
Model or DB Title	Radar Free-Space Detection Range (RFSDR)
Description	The RFSDR model calculates the maximum free-space detection range of a pulse-radar system against a target of specific size. The Free-Space Intercept Range Program calculates the maximum free-space range of an electronic support measure (ESM) receiver.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

E²DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	757
Model or DB Title	Radiosonde Initial Analysis (RIA)
Description	The RIA Program analyzes and displays vertical atmospheric data and provides input to various meteorological and electromagnetic propagation application programs.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dew Point Temperature			
Humidity			
Sea Level Pressure			
Temperature			
Winds			

Tracking No.	758
Model or DB Title	Radio Physical Optics (RPO)
Description	The RPO Program calculates range-dependent electromagnetic system propagation loss within a heterogeneous atmospheric medium where the index of refraction is allowed to vary both vertically and horizontally.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Tracking No.	759
Model or DB Title	Ship Ice Accretion (SHIP ICE)
Description	The SHIP ICE Program provides estimates of ship ice accretion rates vs. time for given wind speed and air and sea-surface temperature at various forecast times.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capabilities

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Temperature			
Winds			

Navy

E^2DIS Survey of Environmental Models and Databases (DBs)

Tracking No.	760
Model or DB Title	Chemical/Biological Agent Vapor, Liquid, and Solid (VLSTRACK) Model
Description	The VLSTRACK model provides approximate downrange hazard predictions for many currently known or suspected chemical and biological agents and for a wide variety of munitions capable of disseminating these agents. The model can be used for operational hazard assessment or for research and development studies. VLSTRACK either uses meteorological input from the multivariate optimum interpolation and/or the Navy Operational Regional Atmospheric Prediction System, or can stand alone by using a uniform field.
Organization	Naval Oceanographic Office
Point of Contact	Not Provided
Address–Line 1	Code: N54
Address–Line 2	Bay St. Louis
Location	Stennis Space Center, MS 39522-5001

Specific Capability and Fidelity

Atmospheric Data	Horizontal Scale	Vertical Scale	Temporal Scale
Dispersion of Agents, Flares, and Plume	0.78125 m	2 m	300 s

Tracking No.	761
Model or DB Title	Seasonal Cloud Amount and Cloud-Free Line-of-Sight (CFLOS) Data for Oceanic Areas
Description	More than 30 reports were prepared in the early 1980s as part of the Oceanic Cloud Analysis for Military Operations (OCAMO) project by the Geophysics Division of the Pacific Missile Test Center. The objective of this project is to relate cloud amount to the utilization of weapons systems and sensors over the seas. The reports provide sets of cloud cover and CFLOS statistics for specific oceanic areas of interest in the Northern Hemisphere. Statistics are presented for the midseason months of January, April, July, and October on frequencies of five maximum cloud amounts at and below eight specified altitudes, and probabilities of CFLOS occurrences at five elevation angles between the surface and seven specified altitudes. These documents were prepared by Mr. Robert de Violini, Dr. Alexis Shlanta, and Mr. Clarence B. Elam, Jr.
Organization	Geophysics Division, Pacific Missile Test Center
Point of Contact	The Commander
Address–Line 1	(Code 0334-1)
Address–Line 2	Pacific Missile Test Center
Location	Point Magu, CA 93042

APPENDIX G

ENVIRONMENTAL MODELS AND DATABASES

IN THE

SURVEY DATABASE

GROUPED ACCORDING TO MAJOR COMPONENTS

OF

MILITARY SIMULATIONS

28 Environmental Databases

Service or Agency	Tracking No.	Title
Air Force:	504	Night Vision Goggle Operations (NOWS) Weather Software Database
	531	DATSAV2 Surface
	532	Summary of the Day
	533	DATSAV2 Satellite
	534	DATSAV2 Rocketsonde
	535	DATSAV2 Upper Air
	536	DATSAV2 Aircraft
	537	PIBAL
	538	Winds Aloft
	539	Radiosonde
	540	Lightning
	541	RTNEPH 6-Month
	542	RTNEPH Histogram
	543	RTNEPH-LMHT/A Hemispheric
	544	3DNEPH 6-Monthly
	545	3DNEPH-LMHT/A Hemispheric
	546	High Resolution Analysis
	551	Snow Depth Climatology
	560	Military Standard 210C
Army:	601	PEGASUS
	613	CLIMAT–The Climatology Model
	629	PFNDAT–Aerosol Phase Function Database
Navy:	701	Seakeeping Evaluation Program (SEP) Wind and Wave Database
	704	Submarine Technological Environmental (STE) Database–Clouds
	711	Create Atmospheric Refractive Data Set (CARDS)
	746	Historical Wind Speed (HWS)
	747	HF Lowest Usable Frequency (HFLUF)
	761	Seasonal Cloud Amount and Cloud-Free Line-of-Sight Data for Oceanic Areas

57 Environmental Effects Models

Service or Agency	Tracking No.	Title
Air Force:	501	Electro-Optical Tactical Decision Aid (EOTDA)
	502	Night Vision Goggle Operations (NOWS)
	503	Air Combat Targeting/Electro-Optical Simulation (ACT/EOS)
	515	Combined Radiation and Release Effects Satellite Space Radiation (CRRESRAD) Model
Army:	610	Smart Weapons Operability Enhancement (SWOE)
	612	BITS–Broadband Integrated Transmittances
	614	COMBIC–Combined Obscuration Model for Battlefield Induced Contaminants
	615	COPTER–Obscuration Due to Helicopter Lofted Snow and Dust Module
	617	FITTE–The Fire Induced Transmission and Turbulence Effects Module
	618	GRNADE–Self-Screening Applications Module
	620	KWIK–A Munition Expenditures Module
	621	LASS–Large Area Screening Systems Application Module
	622	LOWTRN–Atmospheric Transmittance/Radiance Module
	623	LZTRAN–Laser Transmittance Module
	624	MPLUME–Missile Smoke Plume Obscuration Code
	625	NBSCAT–Narrow Beam Multiple Scattering Module
	626	NMMW–Near Millimeter Wave Module
	627	NOVAE–Nonlinear Aerosol Vaporization and Breakdown Effects Module
	628	OVRCST–Contrast Transmission Module
	630	RADAR–Millimeter Wave System Performance Module
	631	REFRAC–Optical Path Bending Code Module
	632	SCAPPIF–Scanning Fast Field Program Module
	633	TARGAC–Target Acquisition Model
	634	UVTRAN–An Ultraviolet Transmission and Lidar Simulation Module
	636	SCAPE–Scanning Parabolic Equation
	637	NAPS–Noise Assessment and Prediction System
	638	Spherical–Ground impedance model based on equations by Attenborough
	639	AGAUS–A Mie Code
Navy:	702	Orbit Determination Program (ODP)
	703	Tactical Environmental Knowledge Base System (TEKBS)
	708	Anti-Air Warfare Aircraft Stationing Aid (AAW)
	710	Battle Group Vulnerability (BGV)
	712	Chaff Corridor Density (CCD) Model
	713	Chaff Trajectory Function (CHATRA) Model
	714	The OAML Navy Standard Radar Sea Clutter (CLUTTER) Model
	715	Chaff Dispersion and Density (CHADIS) Model

57 Environmental Effects Models (Continued)

Service or Agency	Tracking No.	Title
Navy: (continued)	725	Sound Focus (SOCUS)
	727	Standard Electromagnetic Propagation (Standard EM Prop)
	728	Surface-Search Radar (SRR) Range Table
	729	Tomahawk Anti-Ship Missile (TASM) Effective Wind Model
	732	Tactical/Environmental Ship Routing (TESR)
	734	Direct Method Evaporation Duct (DMED) Model
	736	Tropospheric Electromagnetic Parabolic Equation Routine (TEMPER)
	737	Electromagnetic Propagation Conditions Summary (PCS)
	738	Electronic Countermeasures (ECM) Effectiveness Display
	740	Electromagnetic (EM) Coverage Diagram (COVER)
	741	Electromagnetic (EM) Path-loss vs. Range (LOSS)
	742	Electronic Support Measures (ESM) Range Tables
	743	Forward-Looking Infrared (FLIR) System Prediction
	744	Historical Electromagnetic Propagation Conditions (HEPC)
	745	High Frequency Communications (HF COMMS)
	748	Laser Range Prediction (LRP)
	749	HF Maximum Usable Frequency (HFMUF) Program
	754	Platform Vulnerability
	755	Radiological Fallout (RADFO)
	756	Radar Free-Space Detection Range (RFSDR)
	758	Radio Physical Optics (RPO)
	760	Chemical/Biological Agent Vapor, Liquid, and Solid (VLSTRACK) Model

67 Environmental Models

Service or Agency	Tracking No.	Title
Air Force:	505	FASCOD3 (to be FASCODE4 or FASE)
	506	MODTRAN3 (replacing LOWTRAN7)
	507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
	508	Strategic High Altitude Radiance Code (SHARC)
	509	SHARE and MODTRAN Merged (SAMM)
	510	Synthetic 3-D Atmospheric Temperature: A Model for Known Geophysical Power Spectra Using a Hybrid Autoregression and Fourier Technique
	511	Cloud Scene Simulation Model (CSSM)
	512	Atmospheric Radiance Code/Auroral Atmospheric Radiance Code (ARC/AARC)
	513	PLEXUS
	514	Combined Radiation and Release Effects Satellite Proton Flux (CRRESPRO) Model
	516	Improved Aurora Precipitation Model (IAPM)
	517	Interplanetary Shock Propagation Model
	518	Magnetosphere Specification and Forecast Model
	519	Solar Wind Transport Model
	520	Solar Flare Forecast Model
	521	AGRMET
	522	Atmospheric Slant Path Analysis Model (ASPAM)
	523	5-Layer Cloud Model
	524	High Resolution Cloud Prognosis (HRCP)
	525	High Resolution Analysis System/Global Spectral Model (HIRAS/GSM)
	526	Real-Time Nephanalysis (RTNEPH)
	527	Relocatable Window Model (RWM)
	528	Snow Depth (SNODEP)
	529	Surface Temperature Model (SFCTMP)
	530	New Tropical (TRONEW) Cloud Model
	547	Eighth-Mesh Surface Temperature Analysis
	548	Boundary Layer Window Analysis
	549	Upper-Air Window Analysis
	550	Vertical Velocity Analysis
	554	Jacchia Atmospheric Density (JAD) Model, 1970
	555	Space Environmental Specification and Forecast System (SESFS)
	556	Celestial Background Scene Descriptor (CBSD)
	557	AFGL-TR-89-0012, Effects of Rain Attenuation on Satellite EHF Communications in the United States
	558	A Climatological Model for 1-Minute Precipitation Rates
	559	Drop-Size Distribution Associated with Intense Rainfall

67 Environmental Models (Continued)

Service or Agency	Tracking No.	Title
Air Force: (continued)	561	Universal Methods for Estimating Probabilities of Cloud-Free Lines-of-Sight Through the Atmosphere
	562	Estimating Probabilities of Cloud-Free Fields-of-View Through the Atmosphere
	563	Clear and Cloud-Free Lines-of-Sight from Aircraft
	564	Atlas of Cloud-Free Line-of-Sight Probabilities, Parts 1–5: Northern Hemisphere
	566	Probability-of-Cloud Statistics (P Cloud S)
Army:	609	Synthetic Environments
	616	FASCAT–Atmospheric Illumination Module
	619	ILUMA–Natural Illumination Under Realistic Weather Conditions

59 Environmental Models

Service or Agency	Tracking No.	Title
Navy:	705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
	706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
	707	Aircraft Icing (AIRICE)
	709	Meteorological Ballistic Winds and Densities Model (BALWIN)
	719	D-Values
	720	Warnings Plot
	721	Wind Conversion Utility (TRUE WIND)
	722	Tropical Cyclone Module
	723	Tomahawk Land Attack Missile (TLAM) Wind and Temperature Correction
	724	Solar/Lunar Almanac Program (SLAP)
	726	Sea-Surface Temperature Analysis and Composite (SSTAC)
	730	Tomahawk Environmental Calculation Aid (TECA)
	731	Temperature Utility (TEMP UTL)
	733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
	735	Rowland-Rotter Evaporation Duct Model (RRM)
	739	Evaporation Duct Height (EDH) Model
	750	Multivariate Optimum Interpolation (MVOI)
	751	Ooyama Analysis
	752	Pressure Altitude/Density Altitude (PADA)
	753	Pilot Balloon (PIBAL)
	757	Radiosonde Initial Analysis (RIA)
	759	Ship Ice Accretion (SHIP ICE)

APPENDIX H

INDEX OF ATMOSPHERIC DATA TYPES

Model/DB	Title of Model or Database
	AEROSOLS
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
511	Cloud Scene Simulation Model (CSSM)
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
531	DATSAV2 Surface
532	Summary of the Day
541	RTNEPH 6-Month
544	3DNEPH 6-Monthly
545	3DNEPH-LMHT/A Hemispheric
	ATMOSPHERIC ELECTRICITY
531	DATSAV2 Surface
536	DATSAV2 Aircraft
540	Lightning
	CHAFF DISPERSION
712	Chaff Corridor Density (CCD) Model
713	Chaff Trajectory Function (CHATRA) Model
715	Chaff Dispersion and Density (CHADIS) Model
	CLOUDS
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
511	Cloud Scene Simulation Model (CSSM)
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
523	5-Layer Cloud Model
524	High Resolution Cloud Prognosis
526	Real-Time Nephanalysis (RTNEPH)
530	New Tropical (TRONEW) Cloud Model
531	DATSAV2 Surface
535	DATSAV2 Upper Air
536	DATSAV2 Aircraft
541	RTNEPH 6-Month
542	RTNEPH Histogram
543	RTNEPH-LMHT/A Hemispheric
544	3DNEPH 6-Monthly
545	3DNEPH-LMHT/A Hemispheric
546	High Resolution Analysis

Model/DB	Title of Model or Database
	CLOUDS (Continued)
613	CLIMAT–The Climatology Model
704	Submarine Technological Environmental (STE) Database–Clouds
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
707	Aircraft Icing (AIRICE)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
	COMBAT-GENERATED DUST
505	FASCOD3 (to be FASCODE4 or FASE)
614	COMBIC–Combined Obscuration Model for Battlefield Induced Contaminants
	CONTRAIL FORMATION AND DISPERSION
505	FASCOD3 (to be FASCODE4 or FASE)
536	DATSAV2 Aircraft
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
	DEW POINT TEMPERATURE
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
531	DATSAV2 Surface
535	DATSAV2 Upper Air
536	DATSAV2 Aircraft
546	High Resolution Analysis
549	Upper-Air Window Analysis
613	CLIMAT–The Climatology Model
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
707	Aircraft Icing (AIRICE)
731	Temperature Utility (TEMP UTL)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
734	Direct Method Evaporation Duct (DMED) Model
748	Laser Range Prediction (LRP)
751	Ooyama Analysis
753	Pilot Balloon (PIBAL)
757	Radiosonde Initial Analysis (RIA)
	DISPERSION OF AGENTS, FLARES AND PLUMES
760	Chemical/Biological Agent Vapor, Liquid, and Solid (VLSTRACK) Model

Model/DB	Title of Model or Database
	FOG
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
531	DATSAV2 Surface
532	Summary of the Day
541	RTNEPH 6-Month
544	3DNEPH 6-Monthly
545	3DNEPH-LMHT/A Hemispheric
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
	HUMIDITY
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
521	AGRMET
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
525	High Resolution Analysis System/Global Spectral Model (HIRAS/GSM)
527	Relocatable Window Model (RWM)
539	Radiosonde
546	High Resolution Analysis
548	Boundary Layer Window Analysis
613	CLIMAT–The Climatology Model
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
707	Aircraft Icing (AIRICE)
731	Temperature Utility (TEMP UTL)
734	Direct Method Evaporation Duct (DMED) Model
735	Rowland-Rotter Evaporation Duct Model (RRM)
743	Forward-Looking Infrared (FLIR) System Prediction
748	Laser Range Prediction (LRP)
753	Pilot Balloon (PIBAL)
757	Radiosonde Initial Analysis (RIA)
	MIXING RATIO
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)

Model/DB	Title of Model or Database
	NON-NUCLEAR MUNITIONS DETONATION EFFECTS
725	Sound Focus (SOCUS)
	NUCLEAR WEAPONS DETONATION EFFECTS
512	Atmospheric Radiance Code/Auroral Atmospheric Radiance Code (ARC/AARC)
755	Radiological Fallout (RADFO)
	PRECIPITATION
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
511	Cloud Scene Simulation Model (CSSM)
521	AGRMET
527	Relocatable Window Model (RWM)
531	DATSAV2 Surface
532	Summary of the Day
536	DATSAV2 Aircraft
541	RTNEPH 6-Month
544	3DNEPH 6-Monthly
545	3DNEPH-LMHT/A Hemispheric
613	CLIMAT–The Climatology Model
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
730	Tomahawk Environmental Calculation Aid (TECA)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
	RADIATIVE FEATURES
501	Electro-Optical Tactical Decision Aid (EOTDA)
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
508	Strategic High Altitude Radiance Code (SHARE)
509	SHARE and MODTRAN Merged (SAMM)
513	PLEXUS
521	AGRMET
531	DATSAV2 Surface
551	Snow Depth Climatology
555	Space Environmental Specification and Forecast System (SESFS)
616	FASCAT–Atmospheric Illumination Module
617	FITTE–The Fire Induced Transmission and Turbulence Effects Module
619	ILUMA–Natural Illumination Under Realistic Weather Conditions
621	LASS–Large Area Screening Systems Application Module
622	LOWTRN–Atmospheric Transmittance/Radiance Module

Model/DB	Title of Model or Database
	RADIATIVE FEATURES (Continued)
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
	REFRACTIVITY
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
513	PLEXUS
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
555	Space Environmental Specification and Forecast System (SESFS)
626	NMMW–Near Millimeter Wave Module
627	NOVAE–Nonlinear Aerosol Vaporization and Breakdown Effects Module.
630	RADAR–Millimeter Wave System Performance Module
631	REFRAC–Optical Path Bending Code Module
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
708	Anti-Air Warfare Aircraft Stationing Aid (AAW)
711	Create Atmospheric Refractive Data Set (CARDS)
714	The OAML Navy Standard Radar Sea Clutter (CLUTTER) Model
725	Sound Focus (SOCUS)
727	Standard Electromagnetic Propagation (Standard EM Prop)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
734	Direct Method Evaporation Duct (DMED) Model
735	Rowland-Rotter Evaporation Duct Model (RRM)
737	Electromagnetic Propagation Conditions Summary (PCS)
738	Electronic Countermeasures (ECM) Effectiveness Display
740	Electromagnetic (EM) Coverage Diagram (COVER)
741	Electromagnetic (EM) Path-loss vs. Range (LOSS)
	SEA LEVEL PRESSURE
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
525	High Resolution Analysis System/Global Spectral Model (HIRAS / GSM)
546	High Resolution Analysis
613	CLIMAT–The Climatology Model
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
719	D-Values
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
734	Direct Method Evaporation Duct (DMED) Model
735	Rowland-Rotter Evaporation Duct Model (RRM)
748	Laser Range Prediction (LRP)
751	Ooyama Analysis
752	Pressure Altitude/Density Altitude (PADA)

Model/DB	Title of Model or Database
	SEA LEVEL PRESSURE (Continued)
753	Pilot Balloon (PIBAL)
757	Radiosonde Initial Analysis (RIA)
	SMOKE
505	FASCOD3 (to be FASCODE4 or FASE)
531	DATSAV2 Surface
532	Summary of the Day
614	COMBIC–Combined Obscuration Model for Battlefield Induced Contaminants
617	FITTE–The Fire Induced Transmission and Turbulence Effects Module
	STATIC PRESSURE
505	FASCOD3 (to be FASCODE4 or FASE)
535	DATSAV2 Upper Air
549	Upper-Air Window Analysis
734	Direct Method Evaporation Duct (DMED) Model
735	Rowland-Rotter Evaporation Duct Model (RRM)
	TEMPERATURE
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
510	Synthetic 3-D Atmospheric Temperature: A Model for Known Geophysical Power Spectra Using a Hybrid Autoregression and Fourier Technique
521	AGRMET
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
525	High Resolution Analysis System / Global Spectral Model (HIRAS / GSM)
527	Relocatable Window Model (RWM)
529	Surface Temperature Model
531	DATSAV2 Surface
532	Summary of the Day
534	DATSAV2 Rocketsonde
535	DATSAV2 Upper Air
536	DATSAV2 Aircraft
539	Radiosonde
546	High Resolution Analysis
547	Eighth Mesh Surface Temperature Analysis
548	Boundary Layer Window Analysis
549	Upper-Air Window Analysis
613	CLIMAT–The Climatology Model
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
707	Aircraft Icing (AIRICE)

Model/DB	Title of Model or Database
	TEMPERATURE (Continued)
723	Tomahawk Land Attack Missile (TLAM) Wind and Temperature Correction
725	Sound Focus (SOCUS)
726	Sea-Surface Temperature Analysis and Composite (SSTAC)
729	Tomahawk Anti-Ship Missile (TASM) Effective Wind Model
730	Tomahawk Environmental Calculation Aid (TECA)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
734	Direct Method Evaporation Duct (DMED) Model
735	Rowland-Rotter Evaporation Duct Model (RRM)
748	Laser Range Prediction (LRP)
751	Ooyama Analysis
753	Pilot Balloon (PIBAL)
757	Radiosonde Initial Analysis (RIA)
759	Ship Ice Accretion (SHIP ICE)
	TRACE GASES
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
513	PLEXUS
	TRANSMISSIVITY
501	Electro-Optical Tactical Decision Aid (EOTDA)
505	FASCOD3 (to be FASCODE4 or FASE)
507	Moderate Spectral Atmospheric Radiance and Transmittance (MOSART)
512	Atmospheric Radiance Code/Auroral Atmospheric Radiance Code (ARC/AARC)
513	PLEXUS
612	BITS–Broadband Integrated Transmittances
614	COMBIC–Combined Obscuration Model for Battlefield Induced Contaminants
615	COPTER–Obscuration Due to Helicopter Lofted Snow and Dust Module
616	FASCAT–Atmospheric Illumination Module
617	FITTE–The Fire Induced Transmission and Turbulence Effects Module
618	GRNADE–Self-Screening Applications Module
620	KWIK–A Munition Expenditures Module
621	LASS–Large Area Screening Systems Application Module
622	LOWTRN–Atmospheric Transmittance/Radiance Module
623	LZTRAN–Laser Transmittance Module
624	MPLUME–Missile Smoke Plume Obscuration Code
625	NBSCAT–Narrow Beam Multiple Scattering Module
626	NMMW–Near Millimeter Wave Module
627	NOVAE–Nonlinear Aerosol Vaporization and Breakdown Effects Module
628	OVRCST–Contrast Transmission Module
629	PFNDAT–Aerosol Phase Function Data Base
630	RADAR–Millimeter Wave System Performance Module
633	TARGAC–Target Acquisition Model

Model/DB	Title of Model or Database
	TRANSMISSIVITY (Continued)
634	UVTRAN–An Ultraviolet Transmission and Lidar Simulation Module
635	XSCALE– Natural Extinction Module
639	AGAUS–A Mie Code
710	Battle Group Vulnerability (BGV)
727	Standard Electromagnetic Propagation (Standard EM Prop)
728	Surface-Search Radar (SRR) Range Table
740	Electromagnetic (EM) Coverage Diagram (COVER)
741	Electromagnetic (EM) Path-loss vs. Range (LOSS)
742	Electronic Support Measures (ESM) Range Tables
745	High Frequency Communications (HF COMMS)
747	HF Lowest Usable Frequency (HF LUF)
749	HF Maximum Usable Frequency (HF MUF) Program
754	Platform Vulnerability
	VISIBILITY
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
531	DATSAV2 Surface
536	DATSAV2 Aircraft
541	RTNEPH 6-Month
613	CLIMAT–The Climatology Model
743	Forward-Looking Infrared (FLIR) System Prediction
748	Laser Range Prediction (LRP)
	WINDS
504	Night Vision Goggle Operations (NOWS) Weather Software Database
505	FASCOD3 (to be FASCODE4 or FASE)
521	AGRMET
522	Atmospheric Slant Range Path Analysis Model (ASPAM)
525	High Resolution Analysis System/Global Spectral Model (HIRAS / GSM)
531	DATSAV2 Surface
532	Summary of the Day
533	DATSAV2 Satellite
534	DATSAV2 Rocketsonde
535	DATSAV2 Upper Air
536	DATSAV2 Aircraft
537	PIBAL
538	Winds Aloft
539	Radiosonde
546	High Resolution Analysis
548	Boundary Layer Window Analysis
549	Upper-Air Window Analysis

Model/DB	Title of Model or Database
	WINDS (Continued)
550	Vertical Velocity Analysis
613	CLIMAT–The Climatology Model
701	Seakeeping Evaluation Program (SEP) Wind and Wave Database
705	Navy Operational Regional Atmospheric Prediction System (NORAPS)
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
709	Meteorological Ballistic Winds and Densities Model (BALWIN)
711	Create Atmospheric Refractive Data Set (CARDS)
720	Warnings Plot
721	Wind Conversion Utility (TRUE WIND)
722	Tropical Cyclone Module
723	Tomahawk Land Attack Missile (TLAM) Wind and Temperature Correction
725	Sound Focus (SOCUS)
729	Tomahawk Anti-Ship Missile (TASM) Effective Wind Model
730	Tomahawk Environmental Calculation Aid (TECA)
732	Tactical/Environmental Ship Routing (TESR)
733	Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS)
734	Direct Method Evaporation Duct (DMED) Model
737	Electromagnetic Propagation Conditions Summary (PCS)
743	Forward-Looking Infrared (FLIR) System Prediction
746	Historical Wind Speed (HWS)
750	Multivariate Optimum Interpolation (MVOI)
753	Pilot Balloon (PIBAL)
757	Radiosonde Initial Analysis (RIA)
759	Ship Ice Accretion (SHIP ICE)
	WINDS–SPECIFIC FEATURES
531	DATSAV2 Surface
532	Summary of the Day
536	DATSAV2 Aircraft
706	Navy Operational Global Atmospheric Prediction System (NOGAPS)
720	Warnings Plot
722	Tropical Cyclone Module
732	Tactical/Environmental Ship Routing (TESR)

APPENDIX I

INDEX OF NEAR-SPACE ENVIRONMENT DATA TYPES

Model/DB	Title of Model or Database
	AURORAL PARTICLE
512	Atmospheric Radiance Code/Auroral Atmospheric Radiance Code (ARC/AARC)
513	PLEXUS
516	Improved Aurora Precipitation Model (IAPM)
555	Space Environmental Specification and Forecast System (SESFS)
	COSMIC RAYS
555	Space Environmental Specification and Forecast System (SESFS)
	DIFFUSE ZODIACAL EMISSION
513	PLEXUS
556	Celestial Background Scene Descriptor (CBSD)
	ENERGETIC PARAMETERS
514	Combined Radiation and Release Effects Satellite Proton Flux (CRRESPRO) Model
515	Combined Radiation and Release Effects Satellite Space Radiation (CRRESRAD) Model
555	Space Environmental Specification and Forecast System (SESFS)
	GEOMAGNETIC FIELD
513	PLEXUS
518	Magnetosphere Specification and Forecast Model
554	Jacchia Atmospheric Density (JAD) Model, 1970
	GEOMAGNETIC STORMS
514	Combined Radiation and Release Effects Satellite Proton Flux (CRRESPRO) Model
515	Combined Radiation and Release Effects Satellite Space Radiation (CRRESRAD) Model
517	Interplanetary Shock Propagation Model
518	Magnetosphere Specification and Forecast Model
519	Solar Wind Transport Model
520	Solar Flare Forecast Model
555	Space Environmental Specification and Forecast System (SESFS)
	INTERPLANETARY MEDIUM
517	Interplanetary Shock Propagation Model
519	Solar Wind Transport Model
555	Space Environmental Specification and Forecast System (SESFS)

Model/DB	Title of Model or Database
	LOW ENERGY PLASMA ENVIRONMENT
518	Magnetosphere Specification and Forecast Model
555	Space Environmental Specification and Forecast System (SESFS)
	LUNAR PARAMETERS
513	PLEXUS
556	Celestial Background Scene Descriptor (CBSD)
724	Solar/Lunar Almanac Program (SLAP)
	METEOROIDS AND DEBRIS
513	PLEXUS
556	Celestial Background Scene Descriptor (CBSD)
	NEUTRAL ENVIRONMENT
555	Space Environmental Specification and Forecast System (SESFS)
556	Celestial Background Scene Descriptor (CBSD)
	POLAR CAP ABSORPTION
555	Space Environmental Specification and Forecast System (SESFS)
	RADIO BACKGROUND NOISE
513	PLEXUS
	SOLAR PARAMETERS
513	PLEXUS
520	Solar Flare Forecast Model
554	Jacchia Atmospheric Density (JAD) Model, 1970
555	Space Environmental Specification and Forecast System (SESFS)
556	Celestial Background Scene Descriptor (CBSD)
724	Solar/Lunar Almanac Program (SLAP)
	SPORADIC E
555	Space Environmental Specification and Forecast System (SESFS)
	STAR AND PLANETARY POSITIONS
513	PLEXUS
556	Celestial Background Scene Descriptor (CBSD)

Model/DB	Title of Model or Database
	SUDDEN IONOSPHERIC STORMS
555	Space Environmental Specification and Forecast System (SESFS)